Geol. Survey

STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION

Rock Stratigraphy of the Silurian System in Northeastern and Northwestern Illinois

H. B. Willman

ILLINOIS STATE GEOLOGICAL SURVEY
John C. Frye, Chief
Urbana, IL 61801

CIRCULAR 479
1973

CONTENTS

GEOLOGIC SECTIONS

FIGURES

ROCK STRATIGRAPHY OF THE SILURIAN SYSTEM IN NORTHEASTERN AND NORTHWESTERN ILLINOIS

H. B. Willman

ABSTRACT

Silurian age rocks are exposed in northeastern and northwestern Illinois in two large areas, which are separated by a broad north-central area of older strata. On the basis of faunal correlations, the same formation names have been used previously in the two outcrop regions. Inasmuch as these correlations have been found to be partly in error and the same names have been applied to units of greatly differing lithology, the rock-stratigraphic nomenclature is revised and several changes are made in both regions. The Silurian formations have important economic uses, and a number of reference sections are described to aid in the identification of the formations in each region.

INTRODUCTION

Silurian strata form the bedrock surface in large areas in northeastern and northwestern Illinois (fig. 1). In both regions they consist largely of dolomite and have a maximum thickness of about 500 feet. In the Chicago area an understanding of Silurian stratigraphy has been significant in the interpretation of well drilling records for building foundations, for water resources (Suter et al., 1959; Zeizel et al., 1962), and most recently for the deep tunnel system for floodwater and sewage disposal (Buschbach and Heim, 1972). Enormous quantities of stone for building and road construction and for lime, flux, refractories, and building stone have been produced from Silurian strata in northeastern Illinois (Krey and Lamar, 1925; Willman, 1943, 1944). In northwestern Illinois, Silurian rocks have also been quarried in many places and in addition are a reservoir for groundwater (Bergstrom, 1956).

The two areas of Silurian rocks in northern Illinois are separated by an area of older formations along the Wisconsin Arch, the Ashton Arch, the La Salle Anticline, and the Sandwich Fault Zone. South of their outcrop areas, the Silurian rocks are overlapped by Pennsylvanian formations, and the only connection between the two areas occurs in subsurface south of the outcrop areas (Willman et al., 1967, sub-Pennsylvanian geologic map).

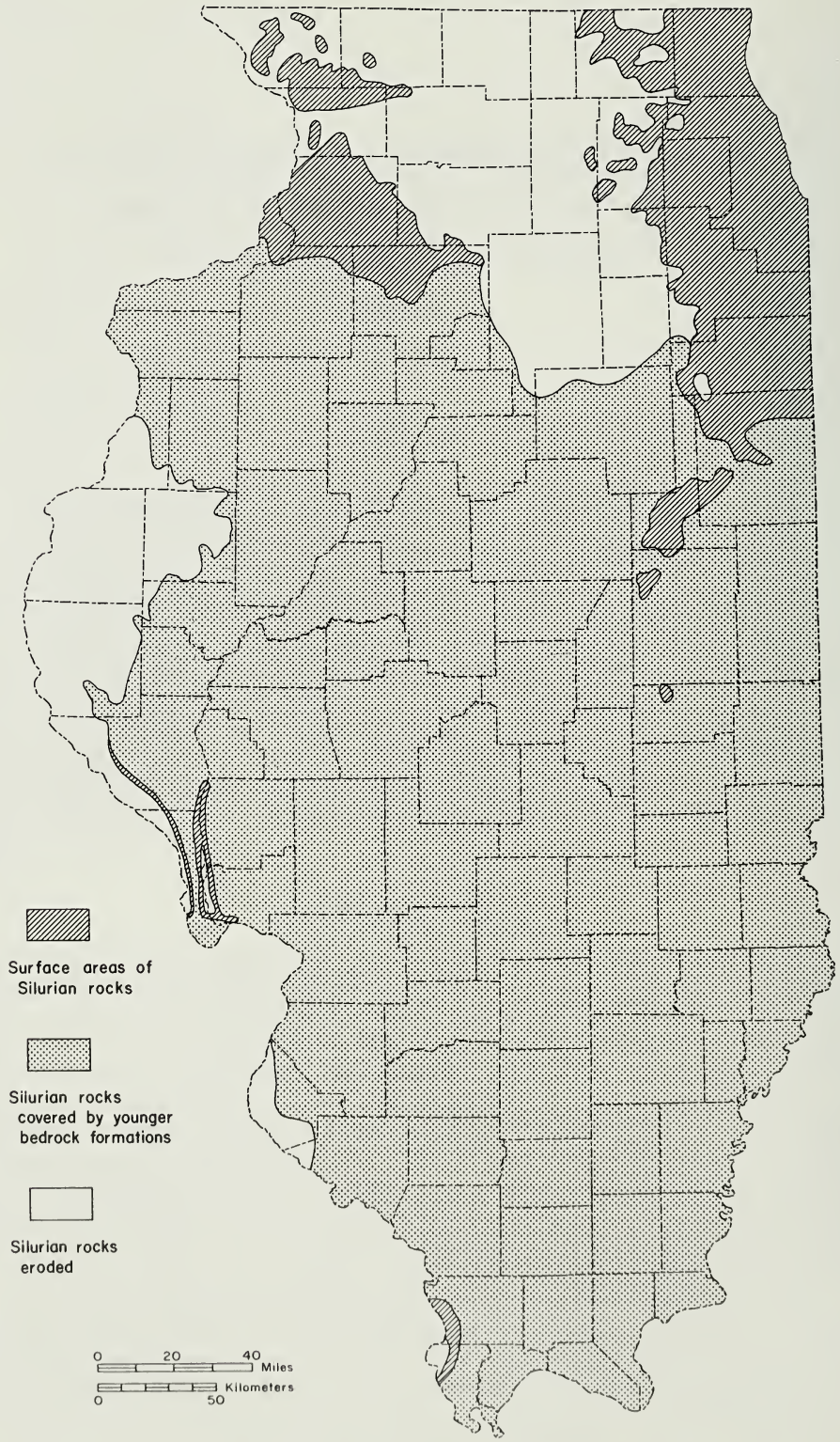


Fig. 1 - Distribution of Silurian rocks in Illinois (modified from State Geologic Map).

This report is largely concerned with the development of a rock-stratigraphic classification of the Silurian strata to conform to present policies (Willman, Swann, and Frye, 1958; American Commission on Stratigraphic Nomenclature, 1961). It summarizes studies of the outcrop and quarry exposures and establishes reference sections. The sections are given at the end of the report, their locations are shown on figures 4 and 7, and the intervals described are shown on figure 10. The report is based in part on outcrop data included in an unpublished Illinois Geological Survey manuscript (1949) on the Silurian of the Chicago region by H. B. Willman (outcrop stratigraphy), L. E. Workman (subsurface stratigraphy), and H. A. Lowenstam (paleontology). The regional correlations are based in part on field conferences in northeastern Illinois and eastern Wisconsin with A. J. Boucot, G. M. Ehlers, H. A. Lowenstam, G. O. Raasch, R. H. Shaver, D. H. Swann, and L. E. Workman.

Most of the Silurian rock units in both northeastern and northwestern Illinois were originally differentiated by T. E. Savage (1912, 1913, 1914, 1926), but the nearly identical sequence in Iowa across the Mississippi River from northwestern Illinois had been differentiated earlier by Iowa geologists, including Savage. Following the practice of his time, Savage named his units on the basis of faunal correlations between the two regions and with other areas, regardless of lithologic composition. Although some of the correlations were in error, the differentiation of the rock units, with a few exceptions, was effective and has been widely used. However, changes in policy requiring development of separate rock- and time-stratigraphic classifications makes necessary a number of changes in nomenclature. The effect of the changes is to restrict the usage of some names and to develop local rock-stratigraphic classifications. This is not an objective, but it provides a base from which use of names can be broadened as relations between the units become better known. A need still remains for a more detailed time-stratigraphic classification based on faunal zonation to show correlations between the areas. Only the major aspects of time-stratigraphy are discussed in the following summary.

TIME-STRATIGRAPHIC CLASSIFICATION

The Silurian System (Murchison, 1835; Lapworth, 1879) in Illinois is subdivided into the Alexandrian, Niagaran, and Cayugan Series (fig. 2). Berry and Boucot (1970), who have published the most recent North American Silurian correlation chart, accept the European classification of Llandovery, Wenlock, Ludlow, and Pridoli Series. All of these except the Pridoli are based on type sections in England and Wales; Pridoli is Czechoslovakian and is somewhat controversial. Berry and Boucot indicate that the top of the Llandovery is low in the Niagaran, the top of the Wenlock is about mid-Niagaran, and the top of the Ludlow is near the top of the Niagaran. This classification, as shown in their correlation chart (1970, pl. 2), does not provide well-defined faunal criteria for differentiation of units of series rank in the Silurian of Illinois. The biostratigraphic classification based on evolution of the graptolites is highly significant in establishing world-wide correlation but has not proved practical in delimiting time-stratigraphic units in the dominantly carbonate rocks of Illinois. The conodonts promise to be more useful for regional correlations (Rexroad, 1970; Rexroad and Nicol, 1971). Despite the inadequacies of the present classification, there is merit in having a series classification based on provincial units, which are more accessible for comparison.

	NORTHWESTERN ILLINOIS		NORTHEASTERN ILLINOIS			
	PREVIOUS	THIS REPORT	THIS REPORT		PREVIOUS	
Series	Formation	Formation	Formation	Member	Formation	Series
NIAGARAN	Racine	Racine	Racine		Racine	NIAGARAN
			Sugar Run		Waukesha	
	Waukesha	Marcus	Joliet	Romeo Markgraf Brandon Bridge	Joliet	
	Joliet	Sweeney	Kankakee	Plaines Troutman Offerman Drummond	Kankakee	ALEXANDRIAN
ALEXANDRIAN	Kankakee	Blanding	Elwood		Edgewood	
	Edgewood	Tete des Morts	Wilhelmi	Birds		
		Mosalem		Schweizer		

Fig. 2 - Classification of Silurian rocks in northeastern and northwestern Illinois.

Alexandrian Series

The Alexandrian Series was named by Savage (1908, revised 1916) for exposures in Alexander County, Illinois. Savage found that fossiliferous strata in the Mississippi Valley, previously included in the Niagaran, were older than the faunas in the Clinton in New York, which contains the oldest fauna in the type Niagaran. He established the top of the Stricklandia pyriformis Zone, called Stricklandinia in some reports, and at present called Microcardinalia triplesiana, as the top of the Alexandrian. This widespread zone occurs at the top of the Brassfield, Kankakee, Sexton Creek, and Sweeney (new this report) Formations, and recognition of it in effect defines, and in some areas redefines, the base of the Niagaran. The Alexandrian Series, therefore, consists of all the Silurian strata including, and older than, the Microcardinalia Zone. Berry and Boucot (1970) correlate the Microcardinalia Zone with the base of the upper Llandovery of Europe. Instead of "Alexandrian," some authors have preferred the terms "Medinan" (Fisher, 1959) or "Albion" (Swartz et al., 1942), both based on the New York section.

Savage (1926) reported the presence of Microcardinalia at the top of the zone of cherty dolomite at Savanna and, therefore, correlated the cherty zone with the Kankakee Dolomite of northeastern Illinois. The zone of Microcardinalia was lost for many years, although Scobey (1938) reported one occurrence at Sabula, Iowa. In 1950 Lowenstam and Willman found Microcardinalia in a zone in the Joliet Formation 20 to 25 feet above the top of the Kankakee at several localities near Savanna. As the strata in northwestern Illinois formerly called Joliet, and herein named Sweeney, are very similar both in lithology and in abundance and variety of corals to the Kankakee of northeastern Illinois, the top of the Alexandrian is raised to the top of the Sweeney; however, it is recognized that more detailed studies of the faunas are needed to confirm the position of this time-stratigraphic boundary in northwestern Illinois.

The widespread occurrence of the closely related Platymerella (in Illinois and areas to the south) and Virgiana (in areas to the north) provides a possible basis for subdivision of the Alexandrian. In some localities as much as half the Alexandrian occurs below the Platymerella Zone.

Niagaran Series

The Niagaran Series (Hall, 1842; Swartz et al., 1942), based on the Niagara Falls Section in New York and restricted by assigning the pre-Clinton strata to the Alexandrian Series, consists in northern Illinois of all the Silurian strata above the Microcardinalia Zone. It contains the faunas characteristic of the Clinton, Lockport, and Guelph of the New York type section. However, the contact of the type Niagaran with the Cayugan above is not marked by a faunal zone that permits definite correlation of the boundary. The Cayugan Series is based on the Salina Group, which lacks marine faunas. Savage (1926) described Guelph fossils in the highest Silurian strata (Racine) in both northeastern and northwestern Illinois, and it appears that the northern Illinois Niagaran is closely equivalent to the type Niagaran.

Cayugan Series

The Cayugan Series (Clarke and Schuchert, 1899; Fisher, 1959), named for Lake Cayuga in New York, is thought not to be represented in the Silurian rocks of northern Illinois. It has been advocated that the Racine reefs of northern Illinois formed part of a barrier enclosing a basin, largely in Michigan, Ontario, and Ohio, in which the Cayugan deposits, including thick evaporites, accumulated (Briggs, 1958, 1962). The concept has merit in explaining the origin of the evaporites, but, if true, it is not possible at present to identify a time plane equivalent to the base of the Cayugan within the Racine Formation. As the Racine is overlain unconformably by Middle and Upper Devonian rocks, Cayugan equivalents, possibly reefs, could have been eroded from northern Illinois. Cayugan strata are present in southern Illinois, where there was essentially continuous sedimentation from Niagaran time to the early Devonian and where the top of the Cayugan Series is in the lower part of the Bailey Formation.

Regional Correlations

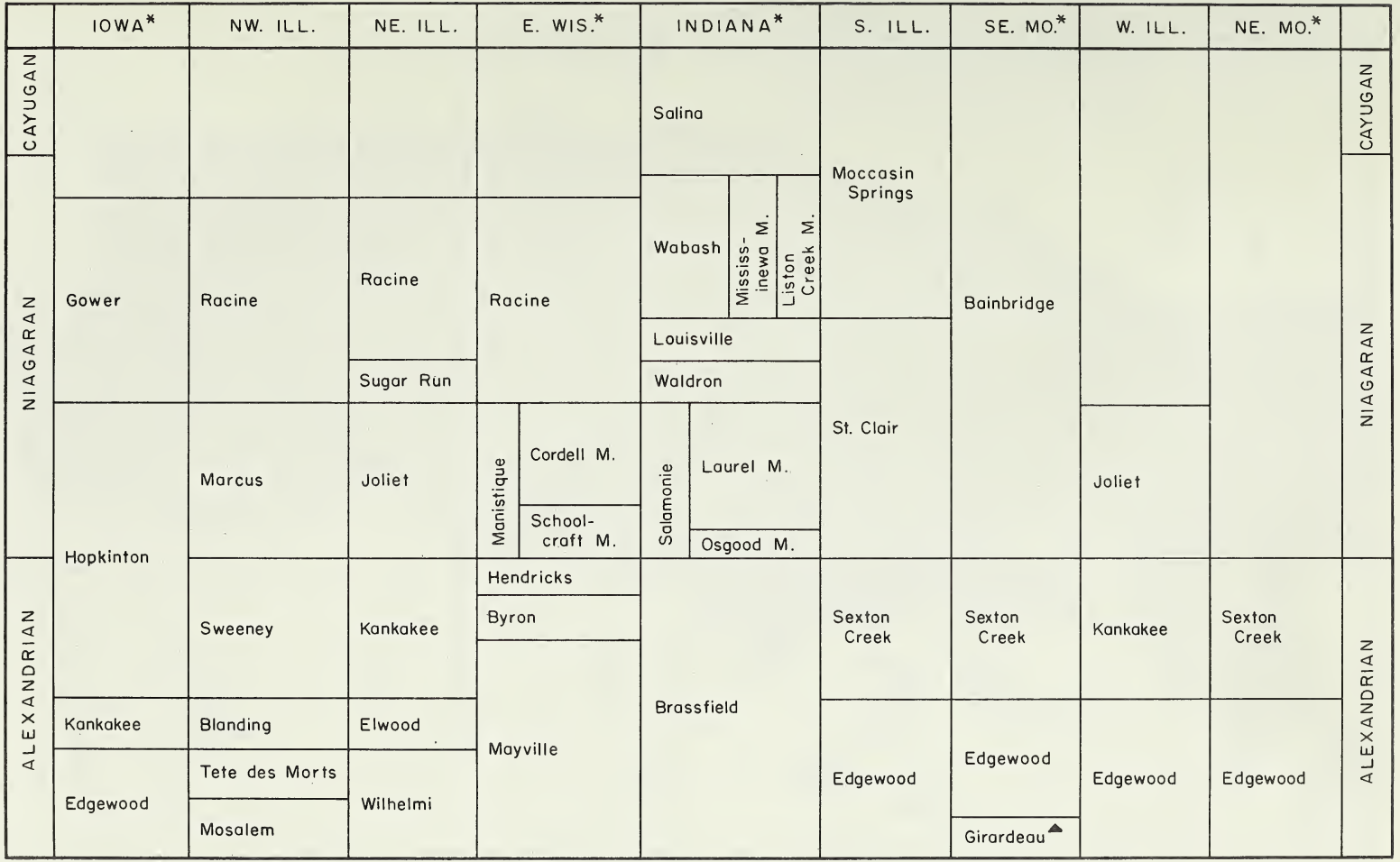
The correlation of the Silurian formations of Illinois with those in adjacent states is shown in figure 3.

NORTHEASTERN ILLINOIS

Silurian age rocks are the uppermost bedrock formations in a large area in northeastern Illinois (fig. 4). The bedrock is largely covered by glacial drift, and exposures are limited to the principal valleys and to quarries in the Chicago Lake Plain (Fisher, 1925; Athy, 1928; Bretz, 1943; Willman, 1943, 1971). In extensive areas the glacial drift is thick and there are no bedrock outcrops. Silurian rocks are also at the bedrock surface in Ford and Iroquois Counties, southwest of the area (fig. 1), but they are deeply buried by glacial drift.

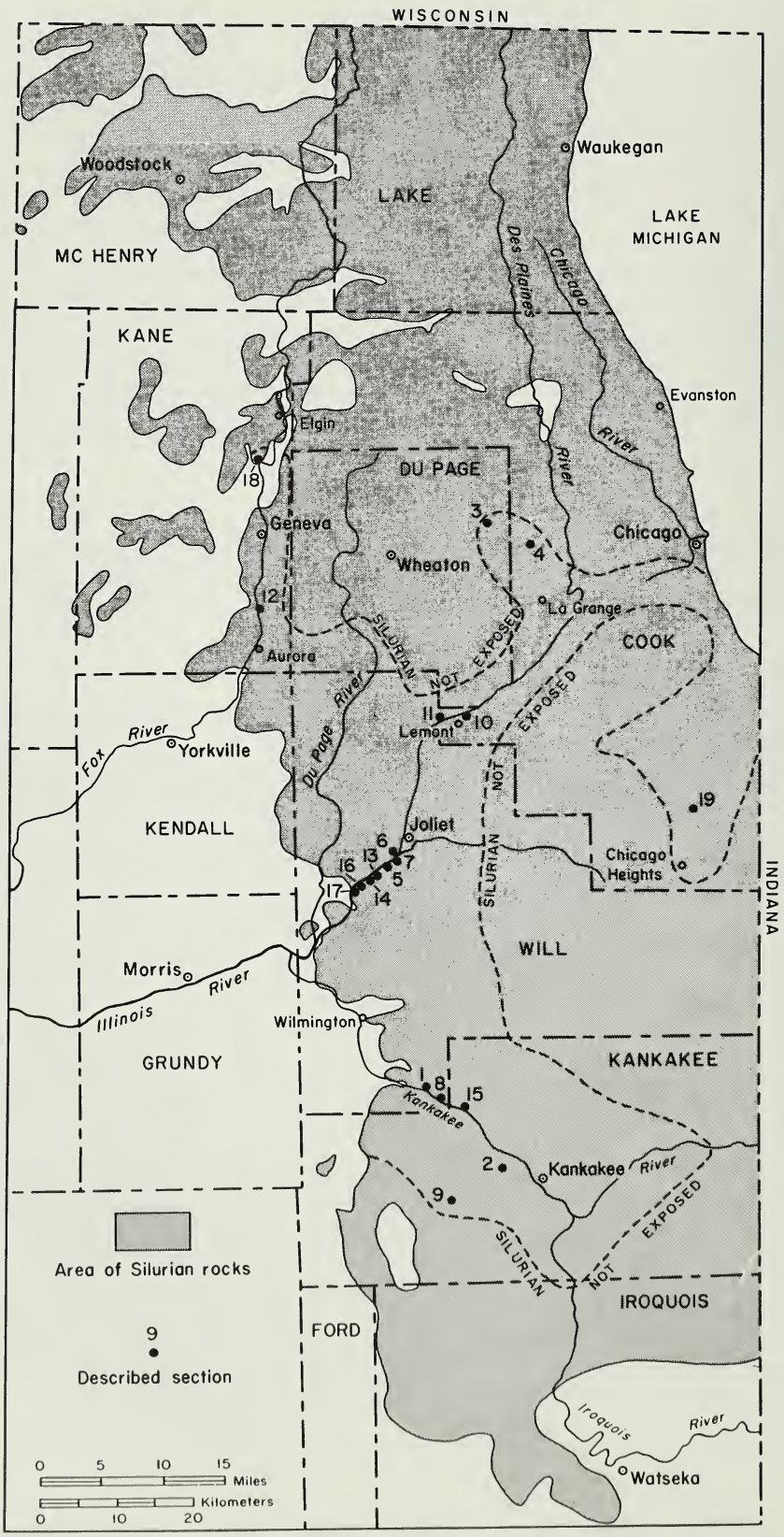
In the outcrop area in northeastern Illinois the Silurian rocks generally have an easterly dip from the Wisconsin Arch into the Michigan Basin. This dip is interrupted by local structures, such as the Des Plaines Disturbance, the Sandwich Fault, and the Herscher Dome. Because of the easterly dip, the oldest Silurian formations are exposed along the west side of the outcrop area along the Kankakee, Des Plaines, Du Page, and Fox Rivers. The youngest are exposed along the Lake Michigan shore and near the Illinois-Indiana state line, where the Silurian rocks are nearly 500 feet thick. The upper 150 feet is exposed in a quarry at Thornton in Cook County. Although the Silurian rocks generally thicken eastward across the area, the thickness varies because of the unconformity at the base, which has a relief of as much as 125 feet, and the presence in the top of drift-filled valleys, which have a local relief of as much as 150 feet (Suter et al., 1959).

The Silurian rocks unconformably overlie the Ordovician Maquoketa Group. They generally rest on the eroded surface of the Brainard Shale, but locally they cut entirely through it and overlie the Fort Atkinson Limestone. The Silurian rocks are separated from the overlying Middle Devonian rocks by a major unconformity. Middle Devonian limestone formations overlie the Silurian rocks in



*Source of nomenclature: Iowa (Hinman, 1968), Wisconsin (Ostrom, 1967), Indiana (Shaver et al., 1970), Missouri (Martin, Larsen, and Muilenburg, 1961).
▲The Girardeau is included in the Ordovician in Illinois.

Fig. 3 - Correlation of the Silurian formations in Illinois and adjacent states.


WISCONSIN
Woodstock
LAKE
Waukegan
LAKE MICHIGAN
MC HENRY
Des Plaines
Chicago
River
KANE
Evanston
Elgin
18
DU PAGE
River
Geneva
3
Chicago
Wheaton
4
12
La Grange
SILURIAN
EXPOSED
COOK
Aurora
NOT
River
EXPOSED
11
10
Lemont
Fox River
Yorkville
Du Page
NOT
19
KENDALL
Joliet
6
7
Chicago Heights
16
13
5
17
14
SILURIAN
INDIANA
Morris
River
WILL
Illinois
Wilmington
GRUNDY
KANKAKEE
8
15
Kankakee
2
Kankakee River
9
SILURIAN
EXPOSED
NOT
IROQUOIS
Area of Silurian rocks
FORD
9
Described section
Iroquois River
Watseka
0 5 10 15
Miles
Kilometers
0 10 20

Indiana a short distance east of Illinois and also along the south edge of the northeastern Illinois area (Willman et al., 1967). Upper Devonian black shale occurs in local pockets in the youngest Silurian at Thornton (Bretz, 1939) and also in even older Silurian rocks at Elmhurst (Weller, 1899; Alden, 1902). This may indicate an overlap of Upper Devonian strata following erosion of the Middle Devonian limestones, but the Upper Devonian shales could have been deposited in joints extending through Middle Devonian strata now eroded.

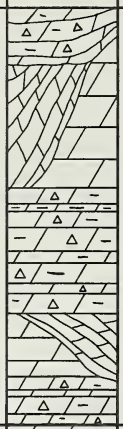
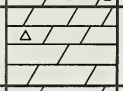
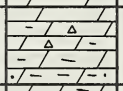
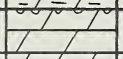
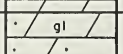
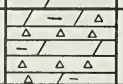
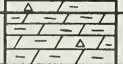
The Silurian rocks of northeastern Illinois are almost entirely dolomite. In a small area near Wilmington, Will County, the Kankakee Formation (fig. 5) is limestone with dolomite mottling. Where the basal Wilhelmi Formation is very thick, the lower 10 to 15 feet is largely a gray dolomitic shale but a thin basal sandstone has been reported locally. A bed of shale as much as 2 feet thick occurs locally in the Brandon Bridge Member of the Joliet Formation, and small patches of shale occur on the flanks of some of the larger Racine reefs. In general, the formations composing the lower half of the Silurian are argillaceous or silty to moderately pure dolomite in units that have a distinctive lithology and can be traced throughout the area. The overlying Racine Formation, which forms the upper half of the Silurian section, consists of pure dolomite in reefs surrounded by argillaceous, cherty dolomite, and no widely traceable lithologic units have been found in it. Consequently, the stratigraphic positions of outcrops in the upper half of the Silurian are based largely on references to some identifiable unit in the lower part of the Silurian.

Development of the Classification

Silurian rocks in northeastern Illinois were early correlated with the Niagara Limestone (fig. 6), and the name "Niagara" was used in Illinois for many years. In 1910 Savage reported pre-Niagaran fossils in a thin limestone exposed about a mile south of Channahon, indicating the presence of the Alexandrian Series, which he had earlier named for exposures in Alexander County, Illinois. By 1926 Savage had developed the classification that has been used with minor changes ever since. However, in 1942, in the Silurian correlation chart, Savage proposed, without adequate explanation or definitions, several changes in the classification that were not accepted (Willman, 1943). By that time studies in the Chicago area and elsewhere in the Midwest had established the reef-interreef relations of some Silurian formations. For that reason, Willman restricted the Waukesha to the distinctive beds that underlie the reef zone and have been quarried widely for building stone. The major part of the Waukesha of Savage, the interreef beds, was included with the reefs in the Racine Formation. Savage's proposal to replace "Waukesha" with "Bellwood" was rejected because his type Bellwood was largely referable to the interreef part of the Racine. Savage (1942) proposed replacing "Port Byron" with the New York-Ontario term "Guelph," but because no lithologic basis could be found for differentiation of the Racine and the Port Byron, the Racine was extended to the top of the Silurian. At the same time, Savage proposed restricting the Joliet by differentiating unspecified basal beds as a new formation, the Rockdale, but the name "Rockdale" was preempted and the unit was left in the Joliet. It presumably included the strata herein differentiated as the Brandon Bridge Member of the Joliet. Lowenstam (1949b) assigned all the Niagaran strata in

---

Fig. 4 - Distribution of Silurian rocks in northeastern Illinois (modified from State Geologic Map). The dashed line roughly outlines the areas where the Silurian rocks have a thick cover of glacial drift and do not crop out. Sections are described on pages 45 to 55.

SERIES	FORMATION	MEMBER	COLUMN	THICK.* (ft)	GENERAL CHARACTER
NIAGARAN	Racine			300	Dolomite, pure, gray, vuggy, in reefs; and argillaceous, silty, brownish gray and greenish gray, cherty dolomite with beds of relatively pure dolomite, between the reefs
	Sugar Run			10–30	Dolomite, slightly argillaceous and silty, light greenish gray, brown-weathering; in smooth-surfaced medium beds; building-stone beds
	Joliet 40′–80′	Romeo		18–34	Dolomite, pure, light gray to white, mottled gray and pink; in faint thin stylolitic beds
		Markgraf		12–28	Dolomite, silty at base to slightly argillaceous at top, very light gray, cherty, medium-bedded
		Brandon Bridge		11–25	Dolomite, argillaceous to shaly, gray, red, green; contains a few pure beds; siliceous foraminifera abundant
ALEXANDRIAN	Kankakee 20′–50′	Plaines		1.5–3	Dolomite, pure, white, massive; contains Microcardinalia and Pentamerus; pitted smooth surface on top
		Troutman		11–29	Dolomite, pure, pinkish gray to greenish gray; in thin wavy beds with green clay partings; corals common
		Offerman		2.5–11	Dolomite, as above, but slightly argillaceous
		Drummond		1–11	Dolomite, as above, but massive, vuggy, glauconitic, locally sandy; contains Platymerella at base
	Elwood			0–30	Dolomite, slightly argillaceous, brownish gray; contains many layers of white chert
	Wilhelmi 0–100′	Birds		0–20	Dolomite, argillaceous, gray, slightly cherty
		Schweizer		0–80	Dolomite, very argillaceous, gray, and dolomitic shale

*Where overlain by next younger unit.

Fig. 5 - Silurian strata in northeastern Illinois.

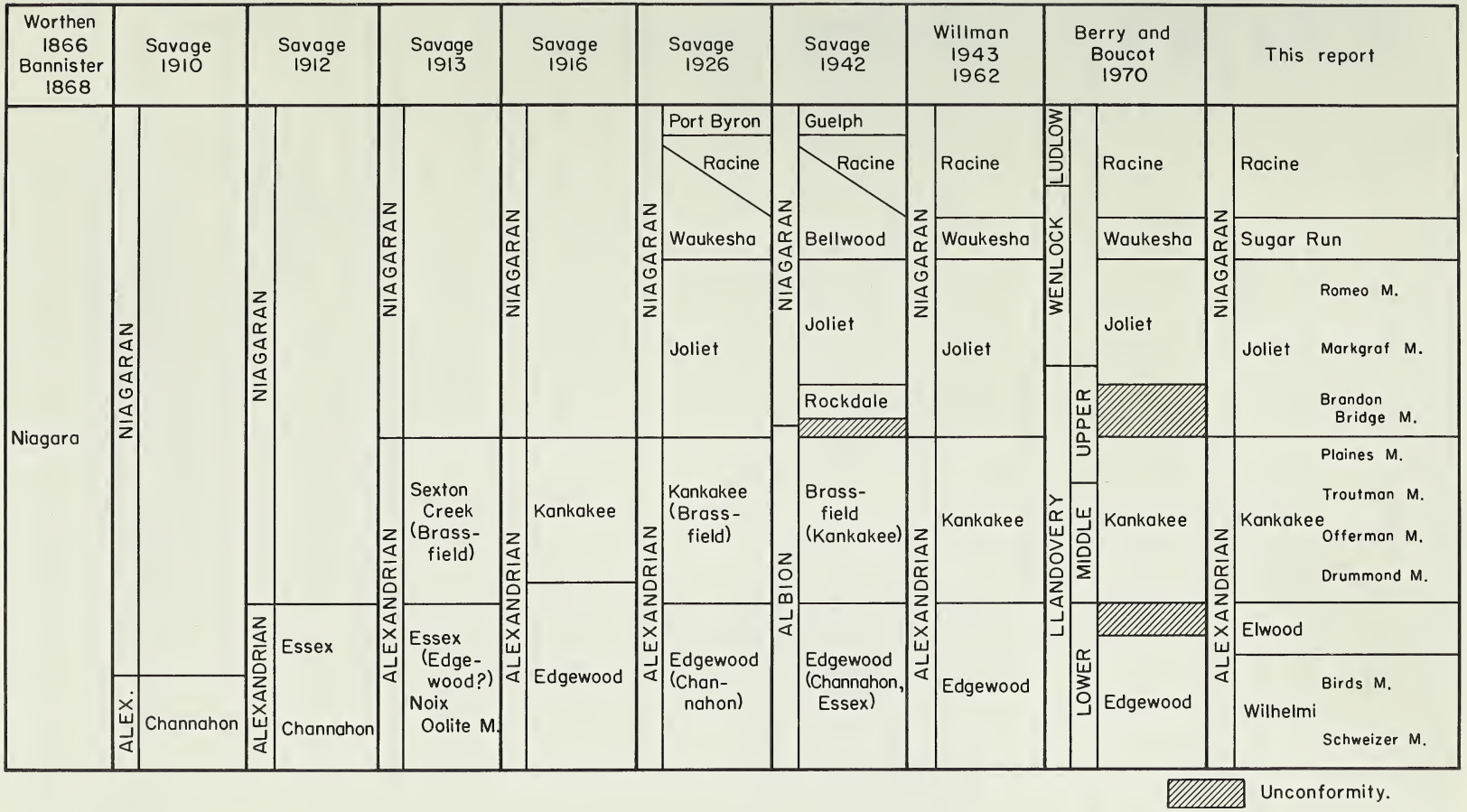


Fig. 6 - Development of the classification of the Silurian System in northeastern Illinois. Most names indicate formations; the exceptions are those in capital letters, which are series names, and those followed by M, which identify members.

northeastern Illinois to the Thorn Group, but this unit was part of a facies classification and the name has not been accepted in rock-stratigraphic classification. Most of the units in the northeastern Illinois Silurian differentiated in the present study were briefly described, but not named, in a previous report (Willman, 1962).

In the present report, the term "Waukesha" is replaced by the local term "Sugar Run," because these strata comprise only part of the section originally included in the Waukesha at Waukesha, Wisconsin. Although the term "Edgewood" has long been used for the basal formation of the Silurian, correlation with the type Edgewood in eastern Missouri was based entirely on fossils and only part of the unit bears lithologic similarity to the type Edgewood. The Edgewood in northeastern Illinois includes two distinctive lithologic units that merit recognition as formations, and therefore the term "Edgewood" is dropped. The only other changes are the differentiation of members in several formations.

Wilhelmi Formation

The Wilhelmi Formation consists of argillaceous dolomite and dolomitic shale that fills, or nearly fills, channels eroded in the underlying Brainard Shale of the Maquoketa Group. In places, the channels cut through the shale to the top of the Fort Atkinson Limestone. The Wilhelmi is as much as 100 feet thick in the deeper channels but is absent or very thin in the areas between the channels. It is overlain by the Elwood Formation, which also thins out in the interchannel areas, with the result that in places the overlying Kankakee Formation overlaps the Elwood to rest directly on thin phases of the Wilhelmi.

The Wilhelmi Formation was formerly the lower part of the Edgewood Formation. It is named herein for Wilhelmi Airport in Will County, 4 1/2 miles northeast of the type section, which is a railroad cut on the southeast side of the Des Plaines River and is described as the Schweizer West Section.*

The Wilhelmi Formation includes the Channahon Limestone, which was named for a few feet of dolomite, at present not exposed, about a mile south of Channahon, Will County (Savage, 1910), and the Essex Limestone, which was named for exposures along Horse Creek, 2 miles east of Essex, Will County (Savage, 1912). Athy (1928) correlated the oolite below the Essex with the Noix Oolite of Missouri and made the Noix and Essex members of the Edgewood. However, the oolite more recently has been correlated with the Ordovician Neda Oolite of Wisconsin (Workman, 1950). The Essex, therefore, was equivalent to the Edgewood, and neither "Channahon" nor "Essex" has been used for many years.

In outcrops, the Wilhelmi is thickest, about 40 feet, in the area of the type section. It is either absent or represented by only a foot or two of argillaceous dolomite in exposures along the Kankakee River from near Ritchey southeast to the Will-Kankakee county line (Cowan's Quarry and Kankakee River Campground Sections). The Wilhelmi is about 15 feet thick in exposures along Horse Creek between Essex and Custer Park in Will County. Along the Fox Valley, it is absent in exposures south of Elgin (South Elgin Section), where the Kankakee Formation rests directly on the shale of the Maquoketa Group. About 3 feet of argillaceous dolomite assigned to the Wilhelmi Formation overlies the Fort Atkinson Limestone of the Maquoketa Group in an abandoned quarry east of Garden Plain (SE SE NW 31, 44N-5E, McHenry Co., Genoa Quad.).

*The described sections and their locations are given at the end of the report. Locations of sections mentioned, but not described in this report, are given in the text.

The Wilhelmi Formation consists of two members: the upper, argillaceous, dolomite is the Birds Member, and the lower, very argillaceous dolomite and dolomitic shale, is the Schweizer Member. The Wilhelmi is differentiated from the overlying Elwood Formation, which is much purer, is not shaly, and contains much chert in persistent layers. Where it is very thick and the basal part is a dolomitic shale, the Wilhelmi is not readily separable from the underlying shale of the Maquoketa Group, particularly in well samples (Ostrom, 1957). However, the Wilhelmi is generally dark gray and the contact is placed at the first appearance of the green shale characteristic of the Brainard Shale. In the type section a thin conglomeratic dolomite bed is considered to mark the base of the Wilhelmi.

The Wilhelmi Formation contains fossiliferous beds, particularly in the upper part. Most of the fossils are dolomitic casts and molds, but Savage (1913) described a large fauna from the Channahon and Essex exposures and Ross (1962a) described graptolites from the Wilhelmi in the Schweizer West Section.

The Wilhelmi Formation is similar lithologically to the Mosalem Formation in northwestern Illinois and in Iowa, and two names may not be necessary for these units. In southern Illinois the strata called Edgewood are somewhat similar to the upper part of the Wilhelmi. North of Illinois in eastern Wisconsin, basal Silurian strata similar to the Wilhelmi appear to be only locally present. In a quarry in High Cliff Park overlooking Lake Winnebago, Calumet County (SW SE 36, 20N-18E, Neenah Quad.), 10 feet of argillaceous dolomite like the Wilhelmi overlies the Maquoketa Shale and underlies 20 feet of moderately pure but very cherty dolomite like the Elwood. Both units are called Mayville in that region. At Katell Falls, near Kolb, Brown County, Wisconsin (SE SE NE 32, 23N-21E, Denmark Quad.), the Mayville consists largely of relatively pure Kankakee, but the lower few feet, overlying the Neda Oolite, is argillaceous dolomite similar to the Wilhelmi.

Schweizer Member

The Schweizer Member of the Wilhelmi Formation consists of very argillaceous dolomite and dolomitic shale. It is locally as much as 80 feet thick but is generally present only where the formation is more than about 20 feet thick. It occurs, therefore, only in the deeper parts of the major channels eroded in the underlying Maquoketa Group. It is overlain by the Birds Member.

The Schweizer Member is named herein for Schweizer School, a mile east of the type section, the Schweizer West Section.

The only good exposures of the Schweizer Member are near the type section, where the upper 15 feet is largely very argillaceous, silty, medium to dark gray dolomite containing beds of dolomitic shale. A few thin beds are fossiliferous. The lower 8 feet is dominantly medium to dark gray shale with a few beds of argillaceous dolomite.

Birds Member

The Birds Member of the Wilhelmi Formation consists of 10 to 20 feet of slightly to moderately argillaceous dolomite that underlies the Elwood Formation and overlies either the Schweizer Member or the Maquoketa Group.

The Birds Member is named for the railroad siding at Birds (Channahon 7.5-minute Quad.), 2 miles northwest of the type section, which consists of two exposures: one, exposing the lower part, is the same as the type section for the Schweizer Member (Schweizer West Section); the other, exposing the upper part, is in a ravine a mile northeast and is described as the Schweizer North Section. The two sections are connected by nearly continuous railroad cuts.

The Birds Member is argillaceous and medium gray and contains only a few scattered nodules of chert. It differs from the Elwood Formation above, which is very cherty, much less argillaceous, and brownish gray. The Birds contains several 2- to 3-inch beds of relatively pure dolomite that have a distinctly laminated surface where weathered. Some of the purer beds are fossiliferous.

Elwood Formation

The Elwood Formation consists of 25 to 30 feet of pure to slightly argillaceous dolomite containing many layers of white chert. It overlies the Wilhelmi Formation and is overlain by the Kankakee Formation. Both contacts are conformable. It is named herein for the town of Elwood, Will County, which is 5 miles south of the type section, a ravine on the southeast side of the Des Plaines River, described as the Schweizer North Section. Although the Elwood is partly covered in this ravine, its relation to both underlying and overlying formations is well shown. Supplementary sections occur in railroad cuts northeast to the Plaines West Section, where the upper 10 feet is well exposed.

The Elwood Formation was previously the upper, cherty member of the Edgewood Formation, but it is lithologically distinct from the underlying argillaceous dolomite of the Wilhelmi Formation and therefore it is differentiated as a separate formation. Although its equivalence to part of the Edgewood of the type area in northwestern Missouri is indicated by its fossils (Savage, 1913, 1926), lithologically it is unlike the Edgewood.

Because of the strong eastward dip, the Elwood Formation is exposed along the Des Plaines Valley only from the Schweizer School area northeast for about 2 miles to the Plaines Station area. It is also exposed along the Fox Valley north of Aurora (North Aurora Section), but it is absent south of Elgin where the Kankakee Formation overlies the Maquoketa Group (South Elgin Section). It is also absent along the Kankakee River at the Cowan's Quarry Section and in quarries at Elmhurst and Hillside. Although absent as a cherty unit along Horse Creek east of Essex, it may be laterally equivalent to argillaceous beds at the top of the Wilhelmi, which contain Platymerella. In the quarry east of Garden Plain, McHenry County, mentioned under Wilhelmi Formation, the Wilhelmi Formation is overlain by 5 feet of dolomite that contains layers of white chert and is assigned to the Elwood Formation.

The Elwood Formation consists of pure to slightly argillaceous, brownish gray dolomite that is dense to slightly vesicular and is largely in 3- to 6-inch beds. It contains dense white chert in layers 2 to 4 inches thick. Chert makes up 40 to 50 percent of the upper part of the formation but is less abundant downward. The Elwood is generally fossiliferous, and silicified corals are common. Although Platymerella manniensis has been considered to mark the base of the overlying Kankakee Formation, it also occurs, especially in chert layers, in the upper few feet of the Elwood Formation.

A similar cherty unit has been recognized in subsurface south of the outcrop region and westward to La Salle County (Elwood Atherton, personal communication). It closely resembles the Blanding Formation in northwestern Illinois, but its continuity with the Blanding has not been established. Its northward continuity has not been traced, but 15 to 20 feet of dolomite containing chert layers in the Mayville south of Pewaukee Lake, Waukesha County, Wisconsin (quarry NE NE SE 23, 7N-18E, Hartland Quad.), is similar to the Elwood. Farther north in Wisconsin 20 feet of cherty dolomite in the Maysville Formation, lithologically like the Elwood, is exposed in High Cliff Park overlooking Lake Winnebago, as mentioned under Wilhelmi.

Kankakee Formation

The Kankakee Formation consists largely of greenish gray to pinkish gray relatively pure dolomite that occurs in thin wavy beds separated by green clay partings. It varies from 20 to 50 feet thick, overlies the Elwood Formation conformably, and is separated from the Joliet Formation above by a diastem.

The Kankakee Formation is named for the Kankakee River (Savage, 1916), and the type section is described in the Cowan's Quarry Section. The Kankakee Formation was described as the strata including the Platymerella manniensis Zone at the base and the Stricklandia pyriformis Zone at the top. Stricklandia pyriformis is now referred to Microcardinalia triplesiana, and the zone is called the Microcardinalia Zone. These zones embrace a distinctive lithologic unit, which justifies retention of the Kankakee as a formation. Savage, in 1942, replaced "Kankakee" with the older name "Brassfield" on the basis of the correlation of the faunal zones with the Brassfield of Kentucky, but this use has not been followed.

The Kankakee Formation, about 40 feet thick, is exposed along the Des Plaines Valley from 3 miles below Brandon Bridge (Schweizer North Section) to the south side of Joliet (Joliet—Lincoln Quarry Section), where the east dip carries it below the Joliet Formation. However, the Kankakee is exposed in deep quarries at Joliet (Joliet—National Quarry Section), at Lockport, and west of Chicago (Elmhurst and Hillside Quarry Sections).

The formation thins southward from the Des Plaines River and is only about 20 feet thick where exposed along the Kankakee River from near Custer Park to Warner Bridge (Cowan's Quarry and Kankakee River Campground Sections). It is at least 30 feet thick where exposed along the Fox River in widely scattered areas from Oswego, Kendall County (quarry in NW SW NW 16, 37N-8E, Aurora South 7.5-minute Quad.), to North Aurora (South Elgin and North Aurora Sections). About 7 feet of the Kankakee Formation is exposed in a shallow quarry 2 miles southeast of Capron, Boone County (NE NE NE 24, 45N-15E, Harvard Quad.).

Although dominantly a relatively pure, greenish gray to pinkish gray, fine- to medium-grained dolomite in thin beds with green clay partings, the Kankakee Formation is subdivided into four members with slightly differing lithologies. A 2- to 3-foot thick bed at the top is pure, massive, nearly white dolomite, and is here differentiated as the Plaines Member. The major and most characteristic part of the formation is the thin-bedded, pinkish gray Troutman Member, which underlies the Plaines. Below it is a thinner bedded, slightly argillaceous unit, the Offerman Member. The basal member is also a pure massive

unit and is named the Drummond Member. The members are all recognizable from Elmhurst and Hillside southward to the Kankakee River, a distance of about 50 miles. The type sections are all in the exposures at Plaines Station, 2 miles southwest of Brandon Bridge, where the members are best developed. The members are all present and more accessible, although thinner, in the Kankakee type section (Cowan's Quarry Section).

The Kankakee Formation contains little chert. A few scattered nodules occur in the Troutman Member, and a few large nodules and lenses occur in the middle and lower parts of the Drummond Member. A few grains of glauconite occur throughout the formation, but they are common only in the Drummond, which also contains scattered grains of quartz sand in some localities. The formation is dolomite in the outcrop area, except in a locality 1 mile east of Wilmington, Will County, where at least the upper 12 feet is a very fine grained limestone (quarry in NW NE NE 31, 33N-10E, Symerton 7.5-minute Quad.).

The Kankakee Formation is generally fossiliferous, and a large fauna has been listed by Savage (1913, 1926) and Athy (1928). Corals are common throughout the formation and silicified corals are particularly abundant in the Drummond Member. Platymerella manniensis occurs in the lower 1 to 2 feet of the Drummond, particularly in chert lenses. Pentamerus oblongus and Microcardinalia occur near the top—in the Plaines Member and the upper part of the Troutman Member.

Although it has been suggested that an unconformity occurs at the base of the Kankakee Formation (Berry and Boucot, 1970), there is no physical evidence of a break at the Kankakee-Elwood contact, which occurs within the Platymerella manniensis Zone. The top of the Kankakee has frequently been interpreted as an unconformity because of its widespread smooth surface (Savage, 1926, 1942; Fisher, 1925; Athy, 1928) and because of missing faunas (Berry and Boucot, 1970). The distinctive smooth surface with its abundant deep pits filled with green clay is similar to corrosion surfaces that occur abundantly in the Ordovician Galena Group formations. The surfaces in the Galena generally truncate only an inch or two of section, and they are considered to indicate minor diastems—intervals of solution rather than deposition (Templeton and Willman, 1963). Because the smooth surface on the Kankakee Formation extends for 50 miles without truncating the 2- to 3-foot Plaines Member, or even showing undulatory relief, it is difficult to interpret the surface as an unconformity. The major unit that appears to be missing at this position is the Marcus Formation of northwestern Illinois (the Schoolcraft Formation of Wisconsin), which contains abundant shells of Pentamerus oblongus. The Marcus Formation could have been deposited in northwestern Illinois during the short interval of nondeposition represented by the smooth surface in northeastern Illinois.

In western Illinois (Calhoun and Jersey Counties), the name "Kankakee" is also applied to the strata that include the Platymerella and Microcardinalia Zones. In that area the formation is a very fine grained limestone, but it has the same bedding characteristics as in the type region and a similar pitted smooth surface on the top. The Kankakee Formation is also correlated with the Sexton Creek Limestone in southern Illinois. It is similar to the Sexton Creek lithologically, and separate names are probably unnecessary. South and southeastward from Illinois, the Kankakee is equivalent to the Brassfield Limestone in southern Indiana, central Kentucky, and western Tennessee.

The Kankakee Formation appears to be equivalent to the Sweeney Formation in northwestern Illinois, which it resembles lithologically. However, the

Tete des Morts Formation in that area has many characteristics of the basal Drummond Member of the Kankakee, and it is not impossible that the Tete des Morts, Blanding, and Sweeney Formations all correlate with the Kankakee. Previously only the Blanding Formation has been correlated with the Kankakee (fig. 2).

The Kankakee Formation thickens northward and in eastern Wisconsin it is equivalent, and similar lithologically, to much of the Mayville and to the Byron and Hendricks Formations. In the type Mayville area in Dodge County, Wisconsin, all of the Mayville appears to be Kankakee (quarry in SW 1, 11N-16E, Horicon Quad.). At the type section of the Neda Oolite, also in Dodge County (NE SE SW 12, 11N-16E, Harrison Quad.), the Mayville is all pure, massive Kankakee resting directly on the Neda, as it does along the Kankakee River in Illinois. The type of the Byron Formation, at Hamilton, Fond du Lac County, Wisconsin (quarry in NE SW 10, 14N-17E, Campbellsport Quad.), is all Kankakee. All of the strata exposed in a quarry at Brillion, Calumet County, Wisconsin (SE SW SW 24, 20N-20E, Chilton Quad.), which have been called Schoolcraft, also appear to be Kankakee. As noted under Wilhelmi, the Mayville at Katell Falls, Brown County, consists largely of Kankakee-type dolomite. The generally massive, nearly white, pure dolomite of the Hendricks Formation in Wisconsin, as much as 40 feet thick, may be equivalent to the few feet of the Plaines Member of the Kankakee Formation in Illinois.

Drummond Member

The massive basal member of the Kankakee Formation is herein named the Drummond Member for the village of Drummond, Will County, 5 1/2 miles southwest of the type section, which is a railroad cut on the southeast side of the Des Plaines River described in the Plaines West Section. It is 8 feet thick in the type section, but it thickens northeastward to 11 feet at Joliet (Joliet—National Quarry Section). It thins southward to 5 feet along the Kankakee River (Kankakee River Campground Section) and to only 1 foot where it rests directly on the Maquoketa Shale Group (Cowan's Quarry Section). The member is also exposed at the base of the deep quarries at Elmhurst and Hillside. It is 8 feet thick in the Fox Valley (North Aurora Section).

The Drummond Member is relatively pure, vesicular, vuggy dolomite similar to that in the Troutman Member, but it differs from the Troutman in being massive and in containing scattered glauconite grains. A few grains of glauconite occur on most surfaces an inch or more square. The unit also contains scattered, well-rounded, medium grains of quartz sand like St. Peter sand. Sand grains are less abundant than the glauconite grains and are not found in some exposures. Silicified corals are abundant. The basal contact is transitional, within an inch or two, to the less vesicular, well-bedded, brownish gray dolomite of the Elwood Formation.

Offerman Member

The Offerman Member of the Kankakee Formation, which overlies the Drummond Member, differs from the Drummond and the overlying Troutman in being slightly argillaceous, less vesicular, and thinner bedded and in having

a smoother, lighter colored weathered surface. It is named herein for Offerman School, which is 3/4 mile southeast of the type section at Plaines Station (Plaines West Section).

The Offerman Member is thinnest, only 2 feet 6 inches thick, in the type section. It is slightly thicker, 3 feet to 3 feet 10 inches, along the Kankakee River, and is 6 to 11 feet thick in the quarries at Joliet, Elmhurst, and Hillside. It has been recognized only in northeastern Illinois.

Troutman Member

The Troutman Member, which overlies the Offerman Member, comprises 50 to 70 percent of the Kankakee Formation and conforms best to the generalized description of the formation as pure, slightly vesicular, greenish gray to pinkish gray dolomite in thin wavy beds with green clay partings. It is named herein for Troutman Grove Cemetery, 2 miles south of the type section, which is in the Plaines East and Plaines West Sections. The two sections, about one-fourth mile apart, are correlated by intervening exposures and by a persistent bed of nearly white clay that occurs in both sections.

The Troutman Member is 27 feet thick in the type section. The principal thickness variations of the Kankakee Formation are in the Troutman, which thins southward, somewhat unevenly, from a maximum of 29 feet at Elmhurst to 11 feet along the Kankakee River. The bed of white clay in the type section is less than 1 inch thick, but it is present in nearly all exposures of the member and makes a strong reentrant. One-half to three-fourths of the member occurs above the clay. The part below the clay is very slightly argillaceous and a little thicker bedded in some sections. The clay resembles bentonite, but is a high-illite clay (analyses by H. D. Glass).

The Troutman Member contains a few widely scattered small nodules of chert. Corals are common throughout the member. It locally contains a few sharply lenticular massive units as much as 2 feet thick and 5 feet across, which the adjoining beds bend over. These masses appear to have stood in relief on the sea floor and are called "baby reefs."

Plaines Member

The Plaines Member is the uppermost member of the Kankakee Formation and generally is a massive bed only 2 to 3 feet thick. It is named herein for Plaines Station, a railroad switching point on the south side of the Des Plaines River, 1 1/2 miles southwest of Brandon Bridge in Will County. The name is shown on early editions of the Wilmington 15-minute topographic map. The type section is in the Plaines East Section, which is an abandoned quarry between two railroads at the east end of a connecting switch. A more accessible supplementary section is in the Lincoln Quarry, south of Brandon Bridge (Joliet—Lincoln Quarry Section).

The Plaines Member is well exposed at many places throughout the area, and it was always found where the top of the formation is exposed. It is 2 feet 2 inches thick in the type section, but varies from 1 foot 6 inches in the Markgraf Quarry at Joliet to 3 feet 4 inches in the National Quarry, less than a mile to the southeast. In exposures from Elmhurst and Hillside to the Kankakee River, it averages 2 feet 4 inches in thickness.

The Plaines Member consists of nearly white, generally massive, moderately vesicular, pure dolomite. In some localities the member, particularly the lower half, contains very thin, green clay partings, as in the Troutman Member below, and where long weathered, it has a bedded appearance. The contact with the Troutman commonly is gradational.

The top of the Plaines Member is the smooth but deeply pitted surface mentioned above and well described in previous reports (see illustrations in Fisher, 1925, fig. 6, p. 28, and fig. 7, p. 29, and in Athy, 1928, fig. 13, p. 45).

As previously noted, the Plaines Member is the Microcardinalia Zone. However, Microcardinalia, along with Pentamerus oblongus, also occurs in the Troutman Member below. The lower part of the Plaines Member is the principal position at which these fossils occur, but they are very erratic in occurrence: clusters of hundreds of specimens occur in places, and none a few feet away. In one locality previously mentioned, a mile east of Wilmington, the Plaines Member is lithographic limestone, and there it contains abundant crinoidal debris along with the pentamerids.

Joliet Formation

The Joliet Formation consists of 40 to 80 feet of dolomite that is shaly and silty at the base, of intermediate purity in the middle, and pure at the top. It overlies the Kankakee Formation and underlies the Sugar Run Formation throughout the outcrop area. However, the latter is not present in subsurface in parts of the region and there the Racine Formation rests directly on the Joliet. The Joliet Formation is named for the city of Joliet (Savage, 1926), and the type section is in a quarry on the south side of Joliet, Will County (Joliet—National Quarry Section). Although Savage later (1942) proposed restricting the Joliet by removing a basal zone, the change was not followed and Joliet is retained in its original definition.

The Joliet Formation is 68 feet thick in the type section and is generally 70 to 80 feet thick where exposed along the Des Plaines Valley from about 2 miles below Brandon Bridge to a quarry in the valley floor about a mile west of Lemont. However, the top is near the valley floor from Joliet to Lemont and the formation is exposed only in quarries in the valley bottom at Joliet (State Prison Quarry), Lockport (Material Service Corporation Quarry), Romeo (abandoned quarries), and Lemont (Lemont West Quarry Section). Farther north and east, the formation is covered by the Sugar Run Formation and is exposed only in the deep quarries at Elmhurst and Hillside. The formation is partly exposed along the Du Page River at and below Naperville, and along the Fox Valley at Batavia. From the type area at Joliet it thins southward to about 40 feet along the Kankakee River. The formation is exposed from the Cowan's Quarry Section, Will County, southeast about 5 miles to Altdorf, Kankakee County. All except the lower 10 feet is well exposed in the Rock Creek Canyon Section.

The formation consists of three members of approximately equal thickness. A basal gray, red, and green shaly dolomite is differentiated as the Brandon Bridge Member. Above it, the dolomite is nearly white, very silty at the base but only slightly silty at the top. It is differentiated as the Markgraf Member. The Romeo Member, at the top, consists of nearly white, pure dolomite. The names "Brandon Bridge," "Markgraf," and "Romeo" were inadvertently used without definition in a previous report (Graf, 1952).

The Joliet Formation is separated from the Kankakee Formation below by a diastem, as previously described. The upper, pure dolomite (Romeo Member) is separated from the typically silty Sugar Run lithology above by an exceptionally uniform gradation through 6 to 7 feet. It is most convenient in field studies to place the boundary at the lowest bedding plane that has a slightly shaly surface. This practice puts the transition zone largely in the Sugar Run Formation.

No lithologic unit comparable to the Joliet Formation occurs in the northwestern Illinois area, but the pure Romeo Member conceivably is equivalent to the massive upper part of the Marcus Formation in that area. The lower part of the Marcus is much purer than the lower Joliet.

Northward from Illinois, the basal red shaly Brandon Bridge Member is exposed in quarries at Burlington, Walworth County, Wisconsin (SW NE NE 36, 3N-18E, Burlington 7.5-minute Quad.), but was not found north of there. The pure, nearly white Romeo Member underlies building-stone beds equivalent to the Sugar Run Formation in a quarry at Waukesha, Waukesha County, Wisconsin (SE SW 26, 7N-19E, Waukesha Quad.). The Joliet lithology was not noted in sections examined north of Milwaukee, but the Joliet may be equivalent, at least in part, to the Cordell Formation.

The southernmost exposure of the Joliet Formation in northeastern Illinois is in the Lehigh Quarry Section about 6 miles south of the Kankakee River, where the white, pure dolomite in the base of the quarry is the Romeo Member. Farther south, the Joliet is recognized in subsurface as a white dolomite (Elwood Atherton, personal communication). In the western Illinois outcrop area (Calhoun County), the strata overlying the Kankakee Formation have been called Joliet, but the basal shaly and silty zones are missing and the thick-bedded, strongly crinoidal limestone has slight resemblance to the type Joliet. Southeastward from the Joliet area, the basal shaly Joliet has long been correlated with the shaly Osgood Formation of southern Indiana (Dunn, 1942), and the overlying Laurel Formation is a nearly white limestone similar to the upper Joliet.

The Joliet is not abundantly fossiliferous, but Savage (1926) listed several fossils. Siliceous foraminifera of considerable variety are abundant in the Brandon Bridge Member, but they decrease in abundance upward as the formation becomes less argillaceous and less silty. They are much more abundant than in other Silurian formations.

Brandon Bridge Member

The Brandon Bridge Member, the shaly zone at the base of the Joliet Formation, is named herein for Brandon Bridge, which crosses the Des Plaines River on the southwest side of Joliet. The type section is in the quarry just south of the bridge (Joliet—Lincoln Quarry Section). The Brandon Bridge is at least partly equivalent to the zone that Savage (1942) removed from the Joliet and named Rockdale. "Rockdale" was preempted, and the name has not been used.

The Brandon Bridge Member is 25 feet thick in the type section and within a foot or two of that in other sections at Joliet and in the deep quarries at Hillside and Elmhurst. It is partly exposed in the Du Page Valley a mile south

of Naperville, Du Page County (quarry in NW NW NE 30, 38N-10E, Naperville Quad.), and in the Fox Valley a mile south of Batavia, Kane County (SE NW 27, 39N-8E, Aurora North 7.5-minute Quad.). The Brandon Bridge Member thins southward from the type locality, and it is only 10 feet 6 inches thick in a small ravine on the north side of the Kankakee River, a quarter of a mile east of Warner Bridge in Kankakee County (NW SE SW 31, 32N-11E, Herscher Quad.).

In the Joliet area, the Brandon Bridge is separated into two parts by a green to black shale, locally as much as 1 foot thick, slightly above the middle of the member. The lower part is more shaly and contains beds of red crinoidal dolomite and greenish gray, very argillaceous dolomite. Some gray beds are mottled with red. The strata above the shale are less shaly and are largely gray, mottled green and red. The upper contact is placed at the highest strong shaly parting. In other areas, the red crinoidal beds are less common and some of the very argillaceous beds are dark red, as at Lemont and Elmhurst. The member is thin bedded, and many bedding planes have fucoidal markings. Except for the siliceous foraminifera, the Brandon Bridge is not very fossiliferous, but large specimens of the trilobite Bumastus are occasionally found, particularly in the middle shaly zone.

Markgraf Member

The Markgraf Member, which overlies the Brandon Bridge, consists of light gray to white, silty to slightly argillaceous dolomite. It is named herein for the Markgraf Quarry on the north side of the Des Plaines River in the southwest part of Joliet, which contains the type section (Joliet—Markgraf Quarry Section). This long-abandoned quarry is now partly filled, but the Markgraf Member is above the fill.

The Markgraf Member is 22 feet thick in the type section, but it varies from 20 to 28 feet in other quarries in the area. In the Du Page Valley only 3 feet are exposed above water level in a quarry on the south side of Naperville, Du Page County (SE SW SE 13, 38N-9E, Naperville 7.5-minute Quad.). The Markgraf is at least 23 feet thick in the Fox Valley, where it is partly exposed in a quarry half a mile south of Batavia, Kane County (NE NE 27, 39N-8E, Aurora North Quad.). Like other Joliet members, it thins southward from Joliet, and it is only 12 feet 3 inches thick in the Rock Canyon Section along the Kankakee River.

The Markgraf Member consists of three units, which are well exposed in the type section and the other two quarry sections at Joliet. The lower unit, 4 to 5 feet thick, is thick-bedded to massive, very light gray, very fine grained, silty dolomite containing about 10 percent insoluble residue. The middle unit, 8 to 9 feet thick, is medium bedded, more argillaceous than silty, and contains 7 to 8 percent insoluble residue. Small nodules of white chert occur in five to seven discontinuous bands. The upper unit, 9 to 12 feet thick, is similar but slightly vesicular and purer, containing only 3 to 5 percent insoluble residue. It contains seven discontinuous bands of chert nodules. Although the three units show a progressive upward increase in purity from the more shaly Brandon Bridge to the pure Romeo, they are sharply defined and not internally gradational. Along the Kankakee River, where the Markgraf is only half as thick as at Joliet, it is all similar to the upper unit but does not contain chert.

Romeo Member

The Romeo Member, the uppermost member of the Joliet Formation, consists of about 25 feet of nearly white, relatively pure dolomite. It is named herein for the village of Romeo in the Des Plaines Valley, 6 miles north of Joliet. Although the member was formerly well exposed in the quarries at Romeo, the quarries are now water filled, and the exposure in the National Quarry in Joliet is designated the type section.

The Romeo Member is 20 feet thick in the type section, but it ranges from 34 feet in the Elmhurst Quarry Section to 18 feet in the Rock Creek Canyon Section in the Kankakee Valley. In the Du Page Valley about 8 feet of the Romeo is exposed in the abandoned quarry on the south side of Naperville. Although not observed in the Fox Valley, it probably forms the top of the Silurian section in the bluffs on the east side of the valley, just south of Batavia.

The Romeo consists of very light gray to white, fine-grained, vesicular dolomite. It is a relatively pure dolomite, containing only 1 to 2 percent insoluble residue. It has a massive appearance on fresh quarry faces, but on weathered surfaces tight, stylolitic bedding planes at 2- to 4-inch intervals are prominent. It commonly has medium to dark gray mottling, and pink mottling is present in many exposures. In the quarries at Joliet three units are recognized: the lower 5 to 6 feet is pink mottled, the overlying 10 feet contains beds and nodules of chert, and the top 6 feet is thicker bedded and contains large vugs. Elsewhere the Romeo contains little or no chert. It is fossiliferous, but the fossils are poorly preserved. Corals are common.

Sugar Run Formation

The Sugar Run Formation, which overlies the Joliet Formation, consists of the well-bedded dolomite, about 25 feet thick, that has been the source of most of the building stone quarried in the Chicago area. It is named for exposures along Sugar Run, a tributary of the Des Plaines River, in the south part of Joliet. The type section is in the Joliet—National Quarry Section, which is on the south side of Sugar Run. Although almost all of the formation is exposed in the quarry, the contact with the overlying Racine is not present. This contact is well exposed on the north side of Joliet in the abandoned quarries north of the state prison, particularly north of State Highway 4A, where it ascends the east bluff of the Des Plaines Valley. In that locality about 20 feet of interreef Racine, which has varied lithologies, overlies 6 feet of the more uniform, evenly bedded Sugar Run (NW NW SE 34, 36N-10E, Joliet 7.5-minute Quad.). The name "Elwood," from a manuscript, was inadvertently used for this unit in a previous report (Graf, 1952).

The Sugar Run Formation was long known as Athens Marble from quarries at Lemont (formerly called Athens) and Joliet Marble for the stone quarried at Joliet. Savage (1926) included the building-stone beds and the overlying interreef beds in the Waukesha Formation, and Willman (1943) restricted the Waukesha to the building-stone beds. However, examination of the type Waukesha at Waukesha, Wisconsin, showed that it is equivalent to parts of the Joliet and Waukesha Formations in northeastern Illinois, and the name "Waukesha" is replaced in Illinois with "Sugar Run."

The Sugar Run Formation is present in the lower part of the Des Plaines Valley bluffs, in parts of the valley floor from Joliet north to Lemont, and in

quarries in the valley floor from Lemont to Sag Bridge. The principal areas of quarrying were along the south side of the valley from Romeo to Sag Bridge and along the east side of the valley at Joliet, particularly on the southeast side of the city. It is also exposed in the deep quarries at Elmhurst, where it is only 10 feet thick, and at Hillside, where it is thickest, 29 feet; at Hillside it is exceptionally silty and more massive than usual. It does not extend as far west as the Du Page and Fox Valleys, where it and younger Silurian strata have been eroded. It extends southward from Joliet, and along the Kankakee River it is exposed from the Rock Creek Canyon Section southeastward for about 5 miles (Eggleston Section). It has been quarried for building stone on the north side of the Kankakee Valley about 3 miles west of Bourbonnais, Kankakee County (NE SW 15, 31N-11E, Kankakee Quad.).

The Sugar Run Formation has a basal transition zone, 6 to 7 feet thick, in which the insoluble residues gradually increase upward from about 2 percent at the base to about 20 percent. The upper 15 to 20 feet of the formation commonly has about 20 percent insoluble residue. The tight, stylolitic bedding planes at the top of the underlying Romeo gradually give way to smooth surfaces at the top of the transition zone; and the smooth, even bedding of the upper part of the formation makes it readily quarriable for building stone.

The building-stone beds consist of light gray dolomite, which is usually slightly greenish on fresh surfaces but weathers yellowish brown, locally reddish brown. The dolomite is dense, very fine grained, and silty. Most beds contain very thin, wavy, green, argillaceous streaks, which are prominent on long-weathered surfaces. The argillaceous streaking is very prominent at the north, in the Elmhurst and Hillside quarries, where the insoluble residues are as high as 30 percent, but it decreases southward and is inconspicuous along the Kankakee River, where the insoluble residues are down to 10 to 15 percent. Farther south, in the Lehigh Quarry Section, the unit is even purer and is differentiated from the Romeo below largely by the presence of smooth bedding surfaces. The beds increase in thickness from 4 to 6 inches at the base to 2 to 3 feet in the middle and upper parts. The Sugar Run generally contains little chert, but chert is abundant in the Hillside and Elmhurst Quarry Sections.

Although the Sugar Run is consistently present in the outcrop areas, studies of samples from borings in the Chicago area indicate that it is absent in parts of the region. Some of the Racine reefs may have started to grow during deposition of the Sugar Run. In areas close to reefs, beds equivalent to the Sugar Run would have the varied characteristics of the interreef rocks and, therefore, would be included in the Racine. The Sugar Run is similar lithologically to many individual beds in the interreef rocks, but its uniformity and continuity through a large area justify its differentiation as a separate formation. Southward it becomes purer and nearly white; and in subsurface south of the outcrop area, it may be included in the Joliet Formation.

Northward, in Wisconsin, strata with a similar lithology are recognized as far as Milwaukee and have been extensively quarried for building stone, called the Lannon Stone. Exposures at Waukesha and Lannon show that the building-stone beds overlie the relatively pure Joliet Formation. The Sugar Run is most impure in the Chicago area, and it may be a westward tongue equivalent to the Rochester Shale of New York.

Fossils are not common in the Sugar Run, but locally some beds contain excellent specimens of Calymene niagarensis, particularly in quarries about a mile northeast of Lemont. Lowenstam (1948) described a fauna from these beds at Lemont.

Racine Formation

The Racine Formation consists of the reef and interreef dolomite overlying the Sugar Run Formation. It is the uppermost Silurian formation and has a maximum thickness of about 300 feet. It was named by Hall (1861) for exposures in quarries at Racine, Wisconsin. The name "Racine" was introduced into Illinois by Savage (1926), but he applied the term only to the reefs (fig. 6). He did not recognize the reef-interreef relations and called the interreef rocks Waukesha. He also called Waukesha the strata that are beneath the reefs and have been quarried for building stone and are here called Sugar Run. At the top he differentiated reef strata that contained fossils characteristic of the Guelph of Ontario and New York as the Port Byron after exposures in northwestern Illinois. Willman (1943) restricted the Waukesha to the building-stone beds at the base, included both reef and interreef strata in the Racine, and extended the Racine upward to include the lithologically similar strata Savage had differentiated as Port Byron. The name "Racine" is continued with that definition. Although the reef and interreef strata are very unlike lithologically, they are not separable as rock-stratigraphic units. The reefs are of all sizes, extend through various stratigraphic intervals, and in places have complex overlapping relations.

The Racine Formation is exposed in the bluffs along the Des Plaines Valley from the southeast side of Joliet to Sag Bridge and from there east in scattered exposures along the Sag Channel to Blue Island and along the main valley to Riverside. Elsewhere in the Chicago area, the Racine is exposed in low hills that project through the glacial drift (Bretz, 1939, 1943; Willman, 1943, 1971). Many of the hills, called klintar, or individually a klint, are reefs. The reef rock is more resistant to weathering than the surrounding interreef rock, which has been more deeply eroded, in part by glacial scour. Because of the eastward dip, the youngest Racine strata are exposed in klintar along the Lake Michigan shore and at Stony Island, Thornton, and Chicago Heights.

Along the Kankakee River, the Racine is exposed from three miles northwest of Kankakee to Momence. It is also exposed, or at a shallow depth, in a large upland area from Kankakee north to Manteno (Willman, 1943). The Racine Formation has been eroded from the area of Silurian rocks along the Du Page and Fox Rivers.

The reefs consist of pure dolomite that is medium to light gray, dark gray mottled, gray weathering, medium grained, and vesicular to highly vuggy. Some of the reefs are more than a mile across, and the reef at Thornton is at least 150 feet thick. The central part, or core, of the larger reefs is poorly or irregularly bedded or massive. The marginal, or reef-flank, beds are well bedded and are largely 4 inches to 1 foot thick, although some are 2 to 3 feet thick. The reef-flank beds dip steeply away from the central core at angles as much as 30 degrees. They represent lateral growth of the reef and consist partly of storm debris from higher parts of the reef. Smaller reefs are massive and do not have reef-flank deposits. The reefs are remarkably free of clay and silt impurities. The insoluble residues are generally less than 1 percent, and in many samples there is almost no residue, or only pellets of the asphaltum that fills vugs in some reefs. Chert was not found in any of the reefs. It is almost never found in the high-purity rocks nor in the highly silty or argillaceous rocks.

The interreef rocks in northeastern Illinois are largely silty, argillaceous, cherty, light gray to brownish gray dolomite that weathers brown. They are well bedded, but the bedding varies in thickness. Marginal to the reefs the strata are highly varied in composition. Some massive, silty, argillaceous, greenish gray beds contain 30 to 40 percent insoluble residue. Some nodular beds grade into nodules in a clay matrix. The impure beds are separated by pure, vesicular, gray dolomite like that in the reefs. Before dolomitization these beds may have been calcarenite consisting of debris washed from the reefs. The interreef rocks more distant from the reefs are more uniform and commonly are slightly argillaceous or argillaceous, dense, brownish gray, cherty dolomite. The character and origin of the reef and interreef rocks in northeastern Illinois have been described in several reports (Bretz, 1939; Willman, 1943, 1962; Willman, Lowenstam and Workman, 1950; Lowenstam, 1950, 1957; Lowenstam, Willman, and Swann, 1956; Ingels, 1963).

Reefs that have a base low in the Racine Formation occur in the Elmhurst Quarry Section; at Sag Bridge, Cook County (SE SW 13, 37N-11E, Sag Bridge 7.5-minute Quad.); along Fraction Run south of Lockport, Will County (SW NE SW 26, 36N-10E, Joliet 7.5-minute Quad.); and along the Kankakee Valley in Kankakee County, especially along the lower part of Davis Creek (SE NW NE 23, 31N-11E, Kankakee Quad.) and in a small deeply incised ravine at the southwest corner of Bourbonnais (N 1/2 NW NW 30, 31N-12E, Kankakee Quad.). Reefs in the middle of the formation occur at La Grange, Cook County (in the Federal and Superior quarries, NW 10, 38N-12E, Berwyn 7.5-minute Quad.) and in quarries near Manteno, Kankakee County (NE SE SE 28, and SW SW SE 33, 31N-12E, Kankakee Quad.). Reefs in the upper part of the formation were formerly well exposed at Stony Island and Chicago Heights, but these exposures are now largely covered. However, the reef at the Thornton Quarry Section is exceptionally well exposed, and its relation to the interreef rocks has been described (Willman, 1962). The interreef rocks are well exposed in the Hillside and Elmhurst Quarry Sections, the Lemont East Bluff Section, and the Thornton South Quarry Section. Many other exposures of reef and interreef rocks have been described (Willman, 1943).

The Racine reefs contain a large and varied fauna in which corals, stromatoporoids, bryozoans, brachiopods, and crinoids are most common and trilobites, gastropods, and pelecypods are not rare (Winchell and Marcy, 1866; Meek and Worthen, 1868; Norton, 1895; Weller, 1900, 1907; Savage, 1926; Fenton, 1931; Grubbs, 1939; Lowenstam, 1942, 1949a, 1950, 1952; Lowenstam, Willman, and Swann, 1956; Ingels, 1963). Fossils are not common in the interreef beds but occur locally in reef detritus. However, Lowenstam (1948) collected a large fauna from a few localities, the fauna differing notably from that in the reefs, with sponges, crinoids, and brachiopods most abundant. A local occurrence of very argillaceous black and green dolomite interbedded with dark brown dolomitic shale in the upper part of the formation at Blue Island, mostly observed from waste piles along the Calumet Sag Channel, has been informally called the Blue Island beds or the Lecthaylus shale for the abundance of this fossil, which is the remains of a marine worm. It also contains graptolites, inarticulate brachiopods, and spores (Roy and Croneis, 1931; Lowenstam, 1948; Ross, 1962b). The large brachiopod Conchidium is abundant on the south slope of a hill 1.5 miles southwest of Manteno, Kankakee County (SW SW SE 20, 32N-12E, Kankakee Quad.), which is near or below the middle of the formation.

The Racine Formation is lithologically like the Racine at Racine, Wisconsin. Farther north in Wisconsin, reefs appear to be more abundant, and the interreef rocks are purer and less cherty, as in northwestern Illinois. The Racine is essentially equivalent and lithologically similar to the Engadine in Michigan. It corresponds to the Lockport and Guelph Formations in Ontario and New York. Westward, the Racine is lithologically like the Racine in northwestern Illinois and the Gower in Iowa. Eastward, in Indiana, it is equivalent to the Wabash Formation, which has reef and interreef strata, the latter more argillaceous than in Illinois. The Racine probably also includes the Louisville Limestone below the Wabash Formation. Southward from the Chicago area, the lower Racine exposed in the Lehigh Quarry Section in Kankakee County is much purer, more uniform, and less cherty than the interreef rocks in the Chicago area. It is largely pink mottled, which relates it to the pink but very argillaceous Moccasin Springs Formation, which occurs in the same position in southern Illinois. However, the Moccasin Springs Formation probably extends much higher in the section, because it grades without noticeable break upward into the Lower Devonian Bailey Formation. The Racine reefs, however, extend southwestward from the Chicago area to the East St. Louis area (Lowenstam, 1949b).

NORTHWESTERN ILLINOIS

The distribution of the Silurian rocks of northwestern Illinois is related largely to the regional southwestern slope away from the Wisconsin Arch; the slope is interrupted in Carroll County by the east-west Savanna Anticline (fig. 7). The anticline is asymmetrical with a relatively steep north slope (about 10°). There is little more than the regional slope southward from the anticlinal axis and northward from the synclinal axis, which is close to the base of the steep northern flank of the structure. The Silurian rocks are entirely eroded along the axis of the anticline. North of the anticline the Silurian rocks cap the many ridges and mounds that distinguish the topography of the Driftless Area (Trowbridge and Shaw, 1916; Willman, 1943). In the glaciated area, only a few mounds persisted through glaciation. South of the anticline the area was glaciated, the streams have not cut through the Silurian rocks, and the topography is much less rugged.

As Devonian rocks overlie the Silurian only at the extreme south margin of the outcrop area, the thickness of the Silurian is related largely to the regional slope, roughly 20 feet per mile, to the topographic irregularities, and to the conformation of the basal unconformity, where there is a relief of about 100 feet. Silurian rocks 50 to 75 feet thick cap some of the mounds in the northern part of the area, and as much as 200 feet occurs in the trough on the north side of the Savanna Anticline. Southward from the axis of the anticline, where they are missing, the Silurian rocks thicken progressively to about 450 feet at Port Byron. A short distance south of Port Byron, they are overlain unconformably by Middle Devonian strata.

The rocks of Silurian age in northwestern Illinois are almost entirely dolomite (fig. 8), the only exceptions being a minor amount of dolomitic shale in the lower part, thin green shale partings in the middle part, and chert, which occurs in nodules and in essentially continuous bands in the middle and lower parts. The Silurian rocks are subdivided into two series—the Alexandrian Series and the overlying Niagaran Series.

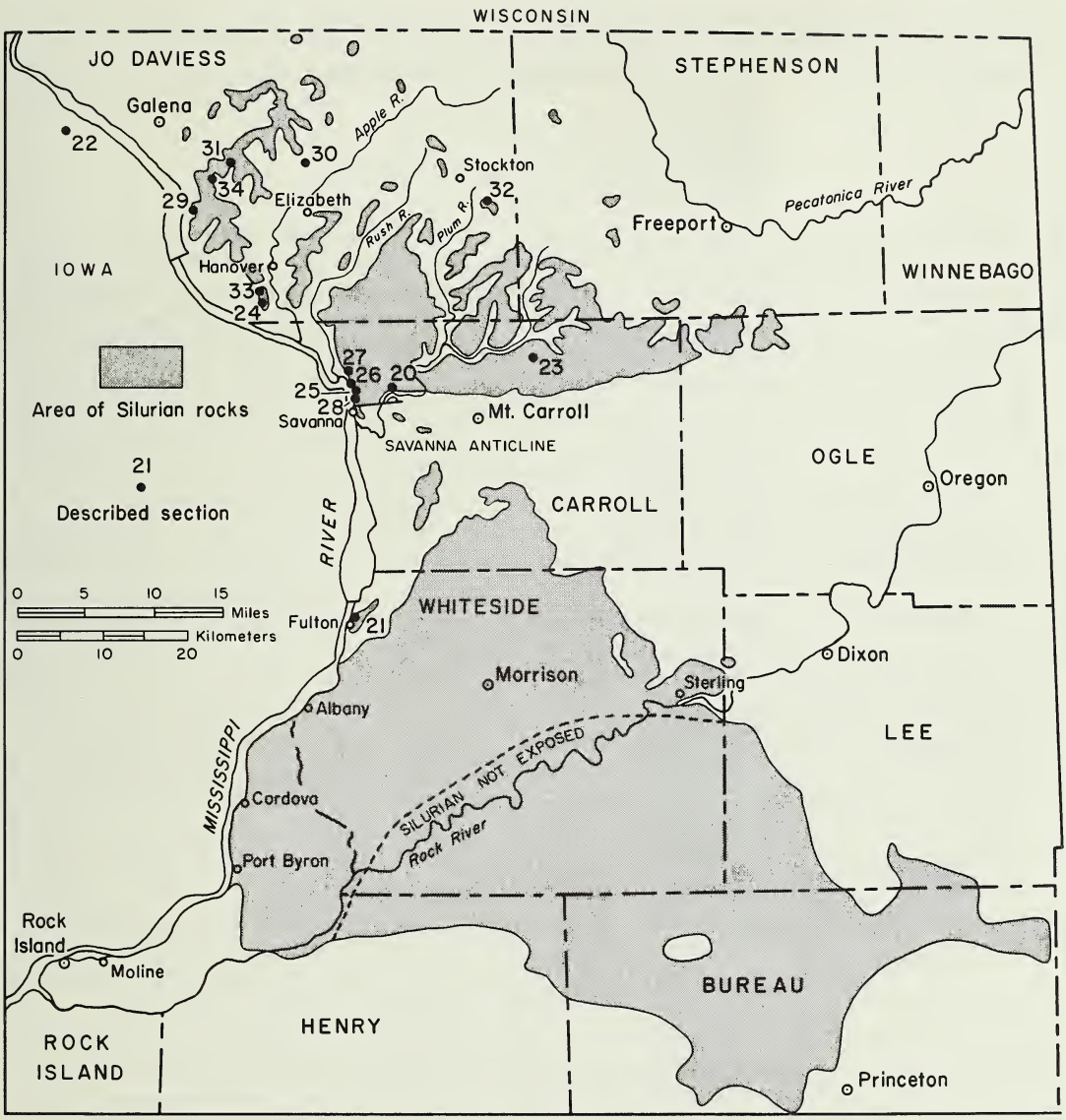
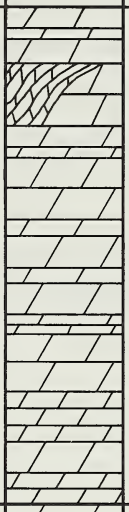
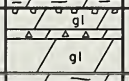
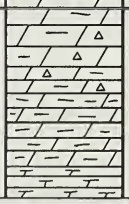


Fig. 7 - Distribution of Silurian rocks in northwestern Illinois (modified from State Geologic Map). The dashed line roughly outlines the area where the Silurian rocks have a thick cover of glacial drift and do not crop out. Sections are described on pages 45 to 55.

The Alexandrian Series was deposited on an uneven surface eroded on the Maquoketa Shale Group, and it thins markedly over the Savanna Anticline. It is as much as 200 feet thick in Jo Daviess County but is less than 100 feet thick in Carroll County. The lower part of the Alexandrian rocks consists of argillaceous dolomite, the middle part is massive, pure, cliff-forming dolomite, and the upper part includes the interval with chert bands and the unit with green shale partings at the top.

The Niagaran Series consists almost entirely of pure dolomite. The lower part is a very massive dolomite characterized by the abundance of Pentamerus oblongus, and the upper part is reef-type dolomite. Reef structures, which are

SERIES	FORMATION	COLUMN	THICK.* (ft)	GENERAL CHARACTER
NIAGARAN	Racine		300	Dolomite, pure, gray, thin-bedded to massive; local reef structures; local areas of brownish gray, argillaceous dolomite
	Marcus		35–45	Dolomite, very pure, buff, vesicular, massive; contains Pentamerus in great abundance in lower 5'-15'
ALEXANDRIAN	Sweeney		45–55	Dolomite, pure, pinkish gray; in thin wavy beds with green clay partings; corals abundant; 3'-5' cherty zone near middle contains Microcardinalia and Pentamerus
	Blanding		35–50	Dolomite, pure, brownish gray; lower 3'-8' slightly argillaceous; contains many layers of white chert; silicified corals abundant
	Tete des Morts		0–24	Dolomite, pure, gray, glauconitic, massive, cliff-forming; persistent chert band in upper part; silicified corals abundant; pitted surface on top
	Mosalem		0–100	Dolomite; upper 20'-30' is argillaceous, gray, cherty, medium bedded; lower part is very argillaceous dolomite grading to dolomitic shale at base

*Where overlain by next younger unit.

Fig. 8 - Silurian strata in northwestern Illinois.

common in Iowa, are only locally present in northwestern Illinois, but the horizontally bedded interreef rocks are also dominantly pure dolomite like that in the reefs. Only a few exposures of argillaceous interreef rock have been noted in the reef-bearing zone.

Development of the Classification

In the first geological survey of the upper Mississippi Valley, Owen (1844) called the Silurian rocks the "coralline and Pentamerus beds of the Upper Magnesian Limestone." Owen overlooked the Ordovician Maquoketa Shale Group, which separates the Silurian from the Galena and Platteville Groups, which comprise the lower part of his Upper Magnesian Limestone. Percival (1856) used the appropriate but informal name "Mound Limestone" for the Silurian rocks. Hall and Whitney (1858) correlated the Silurian rocks with the Niagara Limestone of the New York section, and the name "Niagara" was used in northwestern Illinois by Worthen (1866) and Shaw (1873) (fig. 9).

Iowa geologists, in particular Wilson (1895), Calvin and Bain (1900), and Savage (1906), made the first differentiation of the Niagara Formation. They differentiated but did not formally name most of the units now recognized in northwestern Illinois.

The Silurian strata were correlated with the Niagara, or the Niagara and Clinton (Owen, 1844), until Savage (1914) recognized that the earliest Silurian strata, which he differentiated into the Winston and Waucoma Formations, were equivalent to the pre-Niagaran strata he had previously named the Alexandrian Series (Savage, 1908). His intent was to assign the beds below the prominent chert zone to the Winston and the chert zone to the Waucoma, as shown in figure 9, but unfortunately the type Winston, which was in Illinois, did not include the beds later named Tete des Morts, and the type Waucoma, which was in Iowa, was equivalent to the Winston, as noted by Scobey (1938). Ulrich (1924) also recognized the presence of the pre-Niagaran Silurian beds at Savanna and proposed the name "Burroughs Dolomite" for the strata Savage had previously assigned to the Alexandrian. The Burroughs included two well-defined units, and therefore "Burroughs" has not been used.

In 1926, Savage, entirely on faunal evidence, correlated the units in northwestern Illinois with named units in the Silurian section elsewhere in Illinois and established the nomenclature which has been followed in most details to the present time. Although the nomenclature was based on faunal correlations, the units, except for the similar Racine and Port Byron, are well-defined lithologic units and are essentially those recognized in the earlier work in Iowa. Savage's classification was later summarized and clarified by Sutton (1935) and Weller (1935).

Despite the miscorrelation of several sections, the only significant change in interpretation of the sequence is the recognition, in the present study, that the Tete des Morts Dolomite, the most conspicuous unit in the Galena and Dubuque area, thins out southward and is missing in the section at Savanna, which is the section that has been most frequently studied.

In 1938, Scobey recognized the Edgewood and Kankakee Formations in Iowa, thus restricting the term "Hopkinton" (Calvin, 1906), which had been used for all the Silurian strata below the top of the Pentamerus beds. Because the Hopkinton consists of the two well-defined units that Savage called Joliet and Waukesha, the term "Hopkinton" has not been used in Illinois.

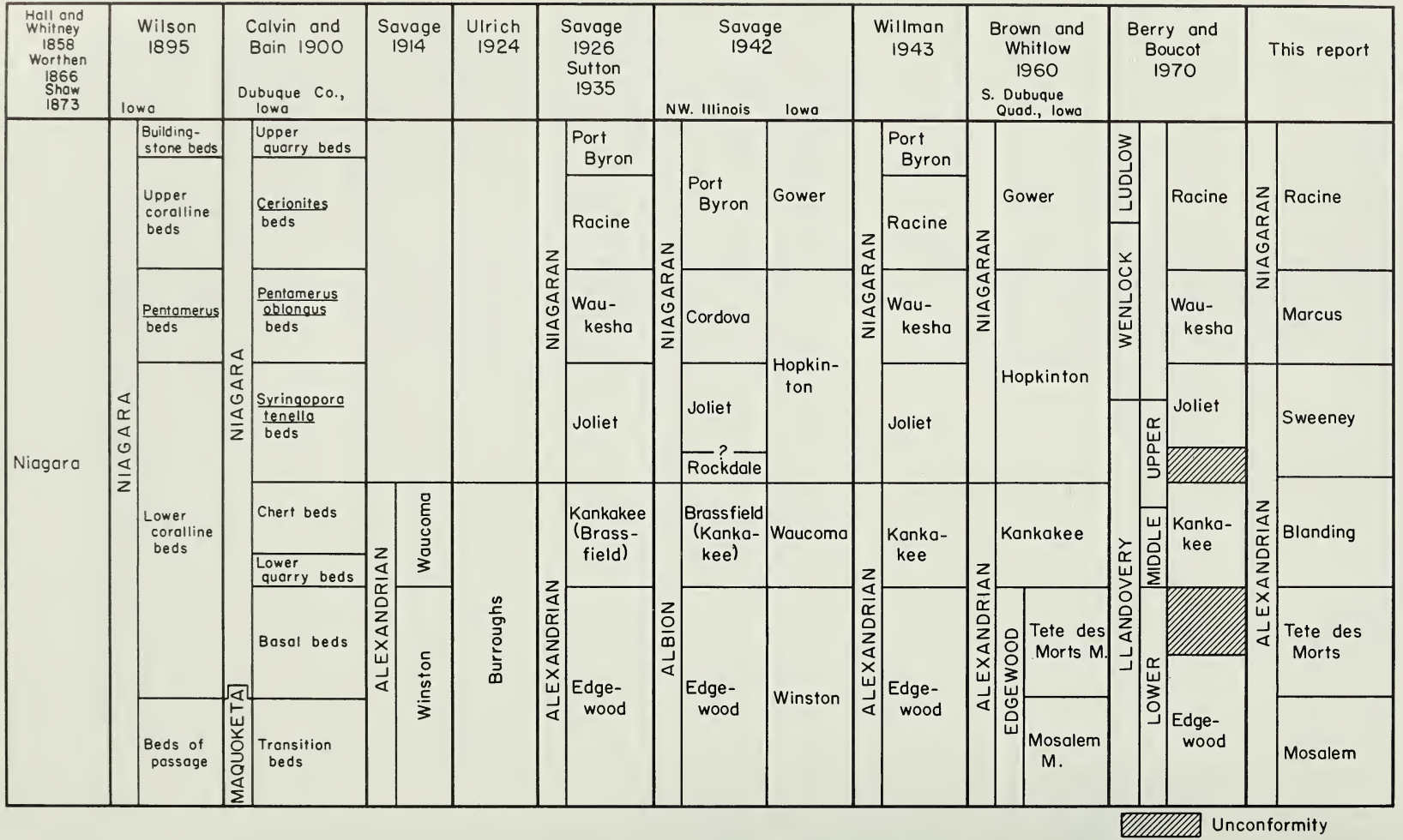


Fig. 9 - Development of the classification of the Silurian System in northwestern Illinois. Most names indicate formations; the exceptions are those in capital letters, which are series names, and those followed by M, which identify members.

In the National Research Council's Silurian correlation chart (Swartz et al., 1942), Savage made several changes in his classification without adequate explanation. He restricted the Joliet Formation by splitting off lower beds, named Rockdale for a locality in northeastern Illinois, that are not recognized either faunally or lithologically in northwestern Illinois. He introduced "Cordova" as a replacement for "Waukesha" and referred the unit to a section which, as noted by Willman (1943), was in the Racine Dolomite and about 16 miles from the nearest strata he had previously called Waukesha. He extended the Port Byron to include the Racine, and he reversed his previous designation of "Kankakee (Brassfield)" to "Brassfield (Kankakee)." The Kankakee had long been correlated with the Brassfield of central Kentucky, but the name "Brassfield" had not been used in Illinois. Inexplicably, he reintroduced "Winston" and "Waucoma" for Iowa, although "Edgewood" and "Kankakee" had been accepted there and the sections on both sides of the Mississippi River are nearly identical.

Although Willman (1943) followed Savage's classification of 1926, he noted that the Racine and the Port Byron were not separable lithologically and that the Joliet was lithologically similar to the Kankakee of northwestern Illinois. Later, the name "Port Byron" was dropped from the classification and "Racine" was expanded to include all the Silurian strata above the Waukesha (Willman et al., 1967).

In 1960 Brown and Whitlow subdivided the Edgewood Formation into two members, applying the name "Tete des Morts" to the massive cliff-forming unit at the top and "Mosalem" to the underlying argillaceous dolomite, units differentiated but not named by Willman and Reynolds (1947).

The revisions in nomenclature of the northwestern Illinois Silurian proposed in this report (fig. 2) are in part based on disagreement with the correlations implied by the previous nomenclature and in part on a change in classification policy, previously described.

Mosalem Formation

The strata previously called Edgewood in northwestern Illinois consist of two distinctive lithologic units that are herein called the Mosalem and Tete des Morts Formations. The Mosalem Formation, the lower unit, is the argillaceous dolomite that Calvin and Bain (1900) called "the transition beds" and assigned to the Maquoketa Shale and that Brown and Whitlow (1960) named the Mosalem Member of the Edgewood Formation. It is the unit that Savage (1914) called Winston for exposures at Winston, at the east end of the Winston tunnel of the Chicago Great Western Railroad, about 6 miles southeast of Galena. However, Savage defined the unit to include all the Silurian strata below the cherty zone, which is the Blanding Formation, and, therefore, included the Tete des Morts Formation, which underlies the cherty zone in the Winston area.

As the Mosalem and Tete des Morts are distinctly different lithologic units, they are herein considered to be formations and the name "Edgewood" is discontinued in northwestern Illinois. The Mosalem Formation lithologically resembles the Wilhelmi of northeastern Illinois and the Cyrene Member of the Edgewood of western and southern Illinois, but the overlying Tete des Morts, previously included in the Edgewood, does not resemble the Edgewood else-

where in Illinois. Although the name "Edgewood" might be restricted to the strata below the Tete des Morts, the term "Edgewood" has been so widely used in a time sense for the Silurian beds below the Platymerella Zone, which is not present in northwestern Illinois, that it seems better to accept the local designation of "Mosalem."

Brown and Whitlow (1960) did not designate a type section for the Mosalem but listed three exposures in Mosalem Township of Dubuque County, Iowa. The unit is poorly exposed at the first two exposures, but it is well exposed at the third—the roadcut of U.S. Highways 52 and 67 south of the village of Kings, described herein as the Kings Section, which can be accepted as the type section. In this section its contact with the overlying Tete des Morts is well exposed and the 60 feet exposed is nearly its entire thickness. One of the best exposures of the Mosalem in northwestern Illinois is in the Royal Princess Section, 6 miles south of Galena, where the upper 50 feet of the Mosalem is exposed. A nearby diamond-drill boring encountered approximately 75 feet of Mosalem overlying the shale of the Maquoketa Group. In some areas in northwestern Illinois, the Mosalem is as much as 100 feet thick, and Brown and Whitlow (1960) reported 94 feet in Iowa. The Mosalem thins almost to absence in some areas, and Savage (1914) reported that it feathers out near Sabula, Iowa. It is only 7 feet thick in Mississippi Palisades State Park at Savanna. As the contact with the underlying Maquoketa is rarely exposed, the total thickness of the Mosalem is not well known, despite the fact that the upper part is very widely exposed beneath the cliff-forming Tete des Morts Formation. The Mosalem is at least 35 feet thick at a quarry 1 mile south of Pearl City, Stephenson County (NE cor. 17, 26N-6E, Lena Quad.), where neither the top nor the base is exposed. It appears to be 70 to 80 feet thick in roadcuts near Schapville (Schapville Southwest Section), but the exposures are not continuous. South of the area in which the Tete des Morts Formation occurs, the Mosalem is overlain by the Blanding Formation and it is generally thinner. It is at least 24 feet thick in the Lost Mound Section, west of Hanover, but in sections near Savanna, both north of the anticline and on it, the Mosalem is 7 to 10 feet thick.

The upper 3 to 8 feet of the Mosalem consists of gray, fine-grained, dense, slightly vesicular, slightly argillaceous dolomite, largely in 1- to 4-inch beds, which distinguishes it from the massive, more pure Tete des Morts strata above. On some fresh surfaces this part of the Mosalem appears to be nearly as massive as the Tete des Morts. It is differentiated by the presence of white chert nodules that commonly occur in three or four bands, but not in layers as in the Blanding. It also contains two or three beds, 2 to 3 inches thick, of vuggy, pure dolomite with fossil debris; these beds were probably coquinas or fossil calcarenites before they were dolomitized. In addition, a 2- to 4-inch bed of finely laminated dense dolomite commonly occurs in the upper 1 to 2 feet and locally elsewhere within the interval. A similar bed occurs also at or immediately below the base. The base generally is a strongly pitted surface, probably a corrosion or solution surface, although locally pebbles of the underlying laminated bed occur immediately above the surface (Whitton Northeast Section). These distinctive beds appear to be nearly continuous from Galena to Savanna but are less prominent to the northeast near Schapville and Stockton.

The middle zone of the Mosalem, 15 to 20 feet thick, is distinctly argillaceous. It is yellow-brown, dense dolomite, massive-appearing on fresh surfaces, but with faint, wavy, thin ridges reflecting variations in the argillaceous

content and imparting a rough surface to deeply weathered exposures. The upper 5 feet commonly contains chalky, white chert nodules, generally scattered but locally in a well-defined band.

The top of the lower zone of the Mosalem is generally marked by 6 inches to 1 foot of very argillaceous, shaly weathering, dark gray, generally black-speckled dolomite or dolomitic shale. Similar beds occur below, separated by 1 to 3 feet of massive, very argillaceous dolomite. The whole zone becomes more argillaceous downward. This zone is present only where the Mosalem is more than 20 to 25 feet thick, but it is as much as 75 feet thick in the areas where the Mosalem is thickest.

Fossils are rare in the Mosalem, except for fossil debris in the thin calcarenitic beds, but Savage (1914) reports a fauna of 11 species from the exposures at Winston, and Scobey (1938) lists 41 species from the Edgewood, many of which probably came from the Tete des Morts, which he included in the Edgewood.

The Mosalem rests unconformably on shale of the Maquoketa Group, and a sharp local relief of 2 feet can be seen at the Palisades Park Main Entrance Section. However, where the Mosalem is thick, the lower shaly unit is not so readily differentiated from the Maquoketa. At Bellevue, Iowa, the contact appears to be almost gradational. However, the fact that uppermost Maquoketa strata, the Neda Formation, consisting largely of oolite, are present only where the Maquoketa is thick and the Mosalem thin suggests that the thick Mosalem fills channels cut into the Maquoketa.

The upper surface of the Mosalem Formation appears to be conformable. Where the overlying Tete des Morts thins out, the uppermost unit of the Mosalem, which contains the distinctive laminated calcarenitic beds, continues southward and the Blanding Formation rests directly on the Mosalem.

Tete des Morts Formation

The Tete des Morts Formation was named the upper member of the Edgewood Formation by Brown and Whitlow (1960, p. 39). It is the prominent cliff-forming unit in the Driftless Area of northwestern Illinois (Willman and Reynolds, 1947, units 5-7). For reasons previously discussed, it is considered a formation in this report.

The Tete des Morts Formation was named for exposures along Tete des Morts Creek in Jackson and Dubuque Counties, Iowa, but no type section was designated by Brown and Whitlow. In the only section they specifically mentioned (in fig. 12), the relations to the overlying and underlying units are not well exposed, and for that reason the Kings Section, herein designated the type section for the Mosalem Formation, is also designated the type section for the Tete des Morts. In the type section, the Tete des Morts is about 24 feet thick and its relations to the Mosalem below and the Blanding above are well exposed.

In northwestern Illinois the Tete des Morts Formation occurs only north of an east-west line approximately through Hanover in southern Jo Daviess County. In the Mississippi River bluffs it is a conspicuous unit from Rice, 5 miles south of Galena, for about 4 miles to the prominent bluff east of Blanding, but it is absent less than 3 miles southeast (Whitton Northwest Section, NW SE NW 18, 26N-2E, Jo Daviess Co., Green Island 7.5-minute Quad.).

The Tete des Morts Formation is well exposed in literally hundreds of localities, particularly on the noses of projecting minor ridges of the strongly dissected Silurian escarpment, which extends north and east from the Mississippi River bluffs to the farthest Silurian outliers in knobs near Stockton and Scales Mound in Illinois and Platteville in Wisconsin. It is described in the Royal Princess, Winston North, Schapville Southwest, and Stockton Southeast Sections. It is uniformly about 20 feet thick, ranging from 18 to 22 feet. Its southward termination was not observed. The formation appears to diminish from a full thickness to absence in about a mile.

The Tete des Morts Formation consists largely of relatively pure, glauconitic, gray, fine- to medium-grained, dense to moderately vesicular, massive dolomite in which corals, particularly Favosites, are common. Chert is persistently present in a thin zone just above the middle. On deeply weathered surfaces, tight bedding planes show faintly at 2- to 4-inch intervals, and in places a few stronger bedding planes break the unit into ledges mostly 2 to 4 feet thick. The weathered surface is medium to dark gray and exceptionally rough, with a sharp irregular relief of 1 to 2 inches, related largely to the uneven texture. The rough surface distinguishes the formation from other Silurian units. In many areas large fallen blocks of the Tete des Morts are common on the debris- and loess-mantled slopes of the Maquoketa and some rest directly on the underlying Galena Dolomite Group. Although the Tete des Morts contains many corals, other fossils are generally scarce and poorly preserved.

The Tete des Morts is subdivided into three unnamed members, referred to as the "lower massive," the "middle cherty," and the "upper massive" units. The lower massive unit is 12 to 15 feet thick. It locally contains scattered chert nodules in the lower 1 foot, and a few chert nodules occur at other horizons. It is sparsely glauconitic.

The middle cherty unit is commonly 2 to 3 1/2 feet thick. The dolomite is slightly argillaceous, dense, and fine grained, and it occurs in well-defined 2- to 4-inch beds. In the middle it contains a persistent 2-inch band of closely spaced chert nodules, which in places becomes a continuous chert layer with scattered chert nodules common above and below. The chert band is so commonly exposed that it makes an excellent marker for structure mapping (Willman and Reynolds, 1947). The cherty unit weathers to a smooth surface and makes a distinct reentrant in most of the cliffs, except in the extreme eastern part of the outcrop area, where it is not as well bedded and does not form a reentrant in the cliff exposures.

The upper massive unit, generally 5 to 8 feet thick, differs from the lower in containing a greater abundance of silicified corals and coarse grains of glauconite. It also contains dense white chert in thin layers or veins 1/8 to 1/4 inch thick and as much as 1 foot long. Layers of veins of chert are only locally present, and much less abundant, in the lower massive unit.

The top surface of the upper massive unit is a smooth but deeply pitted corrosion surface. There is no evidence that it represents more than a diastem. However, in western Dubuque County, Iowa, well-bedded dolomite, as much as 20 feet thick, called the "lower quarry beds" by Calvin and Bain (1900) and assigned to the lower part of the Kankakee by Brown and Whitlow (1960), overlies the Tete des Morts. The quarry beds differ lithologically from the underlying Tete des Morts and the overlying Kankakee (Blanding in this report) and merit classification as a formation, but they are very weakly developed in Illinois.

Although the Tete des Morts is not present south of Hanover, in that area the lower 2 to 3 feet of the Blanding Formation, which is characterized by many layers of chert, contains only a few chert nodules and it might be a lateral equivalent of the Tete des Morts or of the "lower quarry beds" of Iowa. However, it is better bedded than the Tete des Morts and it lacks the glauconite that characterizes the upper Tete des Morts. In many places where the Tete des Morts is present, the lower few feet of the Blanding contains only scattered chert nodules. These beds more likely correlate with the "lower quarry beds," but they lack the well-defined, even bedding of the "lower quarry beds."

The Tete des Morts resembles the basal Drummond Member of the Kankakee Dolomite in northeastern Illinois in containing coarse glauconite and in having an abundance of silicified corals, but it lacks the sand grains and the fossil Platymerella manniensis that occur in that region. More importantly, it occurs below the interval with prominent white chert bands (Blanding Formation), whereas in northeastern Illinois the Drummond occurs above the interval with white chert bands (Elwood Formation).

Blanding Formation

The Blanding Formation consists of dolomite with many layers of white chert, and for many years it was referred to as "the cherty beds." It overlies the Tete des Morts Formation north of Hanover and the Mosalem south of there, and it is overlain by the Sweeney Formation. The Blanding Formation is named herein for the village of Blanding, which is 3 miles south of the type section, an exposure in the upper part of the Mississippi River bluffs described as the Royal Princess Section. The unit was named Waucoma by Savage (1914) but has been called Kankakee since 1926, when Savage correlated it with the Kankakee of northeastern Illinois. As the type section of the Waucoma is Mosalem, the selection of a new type section to revive the name "Waucoma" seems undesirable. As the unit resembles the cherty zone in northeastern Illinois previously included in the Edgewood, and herein named Elwood, the term "Kankakee" is not appropriate, and even if it correlates with the Kankakee, it is a different rock-stratigraphic unit.

The Blanding Formation is 35 to 50 feet thick, and it is present throughout the outcrop area. In the region north of Hanover the lower part commonly caps the hills above the cliffs of the Tete des Morts Formation. South of Hanover the Blanding is well exposed in Mississippi Palisades State Park and along Plum River and its many tributaries (Lost Mound, Whitton Northeast, Lanark Northwest, Palisades Park High Face, Palisades Park Main Entrance, and Winston North Sections).

The Blanding is eroded along the Savanna Anticline, but south of the anticline it descends from the top of the Mississippi bluffs to the floodplain level near the mouth of Otter Creek, 5 miles northeast of Fulton. Farther east, the formation is exposed at many places in the headwaters of Johnson, Otter, and Rock Creeks, as, for example, 1 1/2 miles east of Franklin Corners, Whiteside County (SE SE SE 2, 22N-5E, Morrison Quad.).

The Blanding Formation consists largely of brownish gray to slightly pinkish, fine-grained, slightly vesicular, moderately pure dolomite in 2- to 6-inch beds with generally tight bedding planes. It contains layers of white

chert mostly 1 to 3 inches thick, some as much as 5 inches thick, and commonly separated by 4 to 6 inches of dolomite. Locally the chert forms 50 percent of the unit, but 20 to 30 percent is more common. In some areas the lower 3 to 8 feet is slightly argillaceous, dense, and light gray, and it contains chert in nodules rather than in layers. Silicified corals are common throughout the formation.

The Blanding Formation is similar in lithology to the Elwood Formation of northeastern Illinois, which has been traced in subsurface westward to Peru, La Salle County, but not definitely to the nearest outcrop areas, near Fulton and north of Morrison in northern Whiteside County. The Elwood has previously been included in the Edgewood and the Blanding in the Kankakee on the basis of their faunas, and lacking more definite evidence of their equivalence, local names are used in each outcrop area.

Sweeney Formation

The Sweeney Formation consists of dolomite in thin, wavy beds separated by green clay partings. It generally contains little chert, except near the middle, in a zone about 5 feet thick. It conformably overlies the Blanding Formation and conformably underlies the Marcus Formation throughout the area. The Sweeney Formation is named herein for Sweeney Islands, which occur in the Mississippi River near the type section in Mississippi Palisades State Park, north of Savanna, described as the Palisades Park High Face Section. Part of the type section is in a cliff and difficult to examine, but the lower part of the formation is accessible at other places in the bluffs and also in a quarry northeast of Savanna (Camp Creek Quarry Section) and the upper part is accessible in the Palisades Park Old Quarry Section.

This unit was differentiated as the Syringopora tenella beds in Dubuque County, Iowa, by Calvin and Bain (1900) and later correlated with the Joliet of northeastern Illinois by Savage (1926). As it is lithologically unlike the Joliet and more closely resembles the major part of the Kankakee Dolomite of northeastern Illinois, the name "Joliet" is not appropriate.

The Sweeney Formation is 45 to 55 feet thick. In the area north of Hanover, it and higher Silurian strata are generally eroded, but it is locally present in the southern part of that area in the Mississippi River bluffs (Royal Princess Section) and in the highest roadcuts of U.S. Highway 20, 6 miles east of Galena (Smallpox Creek East Section). From Hanover south it is exposed in many places in the synclinal area north of the Savanna Anticline. Although eroded along the anticline in a belt 4 to 5 miles wide (fig. 7), it is present in the bluffs south of the anticline, gradually lowering until it disappears at floodplain level about a mile south of Otter Creek, 3 miles northwest of Fulton, Whiteside County. Its southernmost exposures along the Mississippi Valley are in quarries at Fulton. In the synclinal area north of Savanna, it is exposed eastward as far as Georgetown, which is north of Lanark, Carroll County; and south of the anticline, it is exposed eastward to Coleta, Whiteside County.

The Sweeney Formation consists largely of light pinkish gray to brownish gray, vesicular, pure dolomite in tight 1- to 4-inch wavy beds with thin green clay partings. In 2- to 5-foot intervals, most commonly at the base and about 20 feet above the base, it becomes very thin bedded and contains strong green

shaly partings. In the high bluff exposures, particularly in Palisades Park, it appears to be massive, but weathering brings out the characteristic thin bedding that differentiates it from the overlying very massive Marcus Formation.

In some exposures the formation is entirely without chert, but a few nodules of chert may be found at scattered positions in many of them. Chert is most abundant in a zone 3 to 5 feet thick, rarely as much as 15 feet thick, the base of which is 15 to 20 feet above the base of the formation. The cherty zone is exposed in the Smallpox Creek East, Lost Mound, Palisades Park North, and Camp Creek Quarry Sections. In this zone the chert locally occurs—with notable variations in quantity—in layers, lenses, and nodules.

The formation is generally fossiliferous, with silicified corals common to abundant in all exposures. Pentamerus oblongus and Microcardinalia occur in a zone that is 15 to 25 feet above the base. Microcardinalia generally occurs in only one or two beds in that interval, commonly in a chert band. Although Microcardinalia, formerly Stricklandia, was reported by Savage to occur at the top of the Blanding (then the Kankakee Formation), it was found in this study, as previously noted, only in the Sweeney Formation. It seems likely that Savage, noting the association with chert, assumed the fossils were in his Kankakee Formation, because there is no indication that he was aware of a cherty zone in the Sweeney Formation. Microcardinalia was found in (1) the Camp Creek Quarry Section; (2) a quarry 1 1/2 miles southwest of there on the north side of Plum River (NW NE SE 35, 25N-3E, Savanna Quad.), where the fossils occur in a cherty zone 3 feet thick, 32 feet below the Marcus Formation; (3) at Bob Upton's Cave in Palisades State Park (NW NW SE SE 33, 25N-3E, Savanna 7.5-minute Quad.), where the fossils are present but scarce in a thin-bedded cherty zone 1 foot above the cave floor, 3 feet above the lower, more massive zone, and about 20 feet above the Blanding Formation; and (4) in a quarry 1 mile east of Hanover (NW NE SE 10, 26N-2E, Hanover 7.5-minute Quad.), where the fossils occur largely at the base of a cherty zone 4 feet thick and 15 feet above the top of the Blanding.

The Sweeney Formation resembles the Kankakee Formation of northeastern Illinois in its thin wavy bedding with green shale partings and the abundance of silicified corals. The presence of Microcardinalia with Pentamerus in the middle part of the Sweeney and in the Plaines Member of the Kankakee of northeastern Illinois further suggests this correlation and favors classification of the Sweeney as Alexandrian. Because the Marcus, which overlies the Sweeney in northwestern Illinois, in no way resembles the Joliet, which overlies the Kankakee in northeastern Illinois, and because the correlation of the basal contacts of the Sweeney and Kankakee also is uncertain, separate nomenclature in the two outcrop areas is preferred.

Marcus Formation

The Marcus Formation consists of about 40 feet of massive pure dolomite, the lower 5 to 15 feet of which is generally a nearly solid mass of shells of the fossil Pentamerus oblongus. It conformably overlies the Sweeney Formation and underlies the Racine Formation throughout the area. It is herein named for the village of Marcus, which is 4 miles northwest of the type section in an abandoned quarry in the south part of Mississippi Palisades State Park in Carroll County (Palisades Park Old Quarry Section).

Although previously identified as "the Pentamerus beds" (fig. 9), the unit was named Waukesha by Savage (1926), who later (1942) proposed the local name "Cordova" for the unit. Savage was under the misapprehension that the beds in the quarry at Cordova, which are Racine, belong to this unit. As the name "Cordova" was not appropriate (Willman, 1943), "Waukesha" continued to be used for the unit. However, the unit differs strongly from the less pure, well-bedded strata of the type Waukesha at Waukesha, Wisconsin, and from the restricted Waukesha of northeastern Illinois, which is renamed Sugar Run in this report. It is stratigraphically at the position of the Joliet Formation of northeastern Illinois, which it also does not resemble.

The Marcus Formation has been eroded from the top of the Silurian section in northwestern Illinois north of Carroll County. It appears at the top of the Mississippi River bluffs northeast of Marcus and about 4 miles north of Savanna. It descends southward to the type section, which is close to the synclinal axis north of the Savanna Anticline, where the base of the formation is about 80 feet above the level of the river. It is sharply truncated a quarter of a mile south of there on the steep slope of the Savanna Anticline. It is absent on the anticline and southward to just north of the Carroll-Whiteside county line. It is exposed in the bluffs southward from there to about 3 miles east of Fulton, where it is exposed in several quarries (SW NE NW 19, 22N-4E, and SE SE NE 24, 22N-3E, Clinton Quad.). It is also exposed in quarries on the north side of Fulton, but south of Fulton it is overlain by the Racine Formation and is below floodplain level.

Along the synclinal axis north of the anticline, the Marcus extends eastward in a narrow belt as far as Shannon in northeastern Carroll County, and in that area it is well exposed in a small quarry along Illinois Highway 78, 2 miles north of Mt. Carroll (SE NW NW 25, 25N-4E, Mt. Carroll Quad.), where small pentamerids crowd the lower 3 feet and very large specimens occur above. From the bluffs at Fulton, the Marcus Formation extends eastward to about 5 miles northeast of Morrison, and it is exposed near Ustick and in quarries at White Pigeon and Malvern.

The Marcus Formation is a high vesicular, very massive, brown, pure dolomite. It commonly occurs in ledges 5 to 15 feet thick without noticeable bedding. Because of the scarcity of exposures showing both top and bottom, variations in its thickness are not well known, but it appears to generally be within 5 feet of 40 feet thick. It forms prominent cliffs in valley bluffs, but in areas where dissection is not deep, it commonly weathers to a dolomite sand, in places 10 to 15 feet thick. The basal contact with the Sweeney Formation is generally distinguished by a sharp reentrant. The abundance of Pentamerus and the massive character of the Marcus generally distinguish it from the Sweeney, which has thin but weak bedding, green clay partings, and abundant corals. However, some pentamerids occur in the Sweeney and corals occur in the Marcus. The contact with the overlying Racine is more difficult, as the latter also is commonly a very pure dolomite. However, the well-bedded character, the variations from dense to highly vuggy texture, and the gray color of the Racine generally distinguish it from the Marcus.

The Marcus Formation is lithologically unlike any other Silurian unit in Illinois. It is equivalent to the upper part of the Hopkinton in Iowa, and the abundance of Pentamerus suggests its correlation with the Schoolcraft in Wisconsin and Michigan, the Fossil Hill in Ontario, and the Reynales in New York.

Racine Formation

In northwestern Illinois, the Racine Formation consists largely of gray, vuggy, pure dolomite about 300 feet thick. It includes all the Silurian dolomite above the Marcus Formation, which it overlies conformably. It is the reef-bearing part of the Silurian section and corresponds to the "upper coralline beds" of early reports (fig. 6).

Savage (1926) introduced the name "Racine" for the lower part and "Port Byron" for the upper part, the differentiation based entirely on faunas—the Racine correlating with the Lockport and the Port Byron with the Guelph in the New York type section. Savage (1942) later suggested that the entire section be called Port Byron in Illinois and Gower (Norton, 1899) in Iowa, although the units are equivalent, especially as Gower has been redefined to include both reef and interreef rocks (Hinman, 1968). As the unit is similar lithologically to the type Racine (Hall, 1861) at Racine, Wisconsin, the name "Port Byron" was dropped in northeastern Illinois (Willman, 1942) and in northwestern Illinois (Willman et al., 1967) and "Racine" used for the entire interval.

North of the Savanna Anticline, the Racine Formation occurs only in a narrow belt along the synclinal axis. The basal 30 feet is exposed at the top of the Mississippi River bluffs in Mississippi Palisades State Park (Palisades Park Old Quarry Section) and also along Plum River, 2 miles east of the park (NW NW NE 2, 24N-3E, Savanna Quad.).

South of the anticline, the Racine is present only south of an east-west line through Fulton, in an area extending eastward from the Mississippi River bluffs to Morrison, Fenton, and Hillsdale. In this area it thickens southwesterly to about 300 feet at Port Byron, south of which it is overlain unconformably by Middle Devonian strata. The lower part of the Racine is exposed in a small quarry 2 miles southeast of Fulton, Whiteside County (SW SW NW 36, 22N-3E, Clinton Quad.) and at Morrison (NE SW SE 7, 21N-5E, Morrison Quad.). The middle part is exposed at Albany (SE NE SE 24, 21N-2E, Clinton Quad.), near Fenton (SE SE SE 32, 21N-4E, Clinton Quad.), and 4 miles northwest of Erie (SW SE 22, 20N-3E, Erie Quad.). The upper part is exposed in quarries at Cordova, Rock Island County (NE NW SW 31, 20N-2E, and NW SE 1, 19N-1E, Cordova 7.5-minute Quad.), and in numerous outcrops in the bluffs along the south side of Meredosia Slough, including a quarry 3 miles north of Hillsdale (NE SE SE 6, 19N-3E, Erie Quad.). The highest part of the Racine is exposed in a quarry on the south side of Port Byron, Rock Island County (NW NW SE 25, 19N-1E, Port Byron 7.5-minute Quad.), in a quarry 2.5 miles southwest of Joslin, Rock Island County (SW 16, 18N-2E, Port Byron 7.5-minute Quad.), and in a quarry south of Cleveland, Henry County (S 1/2 31, 18N-2E, Port Byron Quad.). The Racine Formation is overlain by Middle Devonian limestone in the latter exposure (Edmund and Anderson, 1967).

The Racine Formation is largely a medium gray, fine- to medium-grained dolomite with textures that vary from dense to vesicular to vuggy. It weathers gray. In most outcrops it is well bedded, the beds varying from 2 inches to 4 feet thick. In some exposures the dolomite occurs in massive ledges 10 to 15 feet thick, which may be the cores of reefs. However, steeply dipping reef-flank beds are only locally present, as in the quarry on the south side of Port Byron, and definite reef structures appear to be less common than in the Gower in Iowa (Hinman, 1968). The flat-lying interreef beds generally have the same

pure dolomite as the reefs and, like the reefs, almost entirely lack chert. Argillaceous interreef rocks of the types associated with reefs in northeastern Illinois are exposed at only a few localities, generally interbedded with reef-type dolomite, as near Albany (SE SE NE 25, 21N-2E, Clinton 7.5-minute Quad.), but as these rocks are more readily weathered than the reef-type dolomite, they may be more common than indicated by the outcrops.

The Racine Formation in northwestern Illinois is essentially equivalent to the Racine in northeastern Illinois; but because of differences in the underlying formations, there is no assurance that the basal contact is the same nor that the upper surface, truncated by Middle Devonian strata in both areas, is the same. Savage (1926) identified upper Niagaran Guelph fossils in the youngest Racine in both areas. The Racine is probably equivalent to the lower and middle parts of the Moccasin Springs Formation in central and southern Illinois.

REFERENCES

Alden, W. C., 1902, Description of Chicago district, Illinois-Indiana: Chicago Folio: U.S. Geol. Survey Geol. Atlas Folio 81, 14 p.

American Commission on Stratigraphic Nomenclature, 1961, Code of stratigraphic nomenclature: Am. Assoc. Petroleum Geologists Bull., v. 45, p. 645-665.

Athy, L. F., 1928, Geology and mineral resources of the Herscher Quadrangle: Illinois Geol. Survey Bull. 55, 120 p.

Bannister, H. M., 1868, Geology of Cook County, in A. H. Worthen, 1868, Geology and palaeontology: Geol. Survey of Illinois, v. 3, p. 239-256.

Bergstrom, R. E., 1956, Ground-water geology in western Illinois, north part: Illinois Geol. Survey Circ. 222, 24 p.

Berry, W. B. N., and A. J. Boucot, 1970, Correlation of the North American Silurian Rocks: Geol. Soc. Amer. Spec. Paper 102, 289 p.

Bretz, J H., 1939, Geology of the Chicago region. Pt. 1. General: Illinois Geol. Survey Bull. 65, 118 p.

Bretz, J H., 1943, Chicago area geologic maps: Illinois Geol. Survey.

Briggs, L. I., 1958, Evaporite facies: Jour. Sed. Petrology, v. 28, p. 46-56.

Briggs, L. I., 1962, Niagaran-Cayugan sedimentation in the Michigan Basin, in Silurian rocks of the southern Lake Michigan area: Michigan Basin Geol. Soc. Ann. Field Conf., p. 58-60.

Brown, C. E., and J. W. Whitlow, 1960, Geology of the Dubuque South Quadrangle, Iowa-Illinois: U.S. Geol. Survey Bull. 1123-A, p. 1-93.

Buschbach, T. C., and G. E. Heim, 1972, Preliminary geologic investigations of rock tunnel sites for flood and pollution control in the greater Chicago area: Illinois Geol. Survey Environmental Geology Notes 52, 35 p.

Calvin, Samuel, 1906, Notes on the geological section of Iowa: Jour. Geology, v. 14, p. 571-578.

Calvin, Samuel, and H. F. Bain, 1900, Geology of Dubuque County: Iowa Geol. Survey, v. 10, p. 379-622.

Clarke, J. M., and Charles Schuchert, 1899, The nomenclature of the New York series of geological formations: Am. Jour. Sci. (n.s.), v. 10, p. 874-878.

Dunn, P. H., 1942, Silurian foraminifera of the Mississippi Basin: Jour. Paleon., v. 16, p. 317-342.

Edmund, R. W., and R. C. Anderson, 1967, The Mississippi River Arch: 31st Ann. Tri-State Geol. Guidebook: Augustana College, Rock Island, Ill., 64 p.

Fenton, C. L., 1931, Niagaran stromatoporoid reefs of the Chicago region: Am. Midland Nat., v. 12, p. 203-212.

Fisher, D. J., 1925, Geology and mineral resources of the Joliet Quadrangle: Illinois Geol. Survey Bull. 51, 160 p.

Fisher, D. W., 1959, Correlation of the Silurian rocks in New York State: New York State Mus. and Sci. Service Geol. Survey Map and Chart Ser. No. 1.

Graf, D. L., 1952, Preliminary report on the variations in differential thermal curves of low-iron dolomites: Am. Mineralogist, v. 37, p. 1-27; Illinois Geol. Survey Rept. Inv. 161, 27 p.

Grubbs, D. M., 1939, Fauna of the Niagaran nodules of the Chicago area: Jour. Paleon., v. 13, p. 543-560.

Hall, James, 1842, Geology of the Western States: Am. Jour. Sci., v. 42, p. 51-62.

Hall, James, 1861, Descriptions of new species of crinoidea; from investigations of the Iowa Geological Survey. Preliminary notice: Albany, N. Y., 19 p.

Hall, James, and J. D. Whitney, 1858, Report of the geological survey of the State of Iowa: v. 1, pt. 1, 472 p.

Hinman, E. E., 1968, A biohermal facies in the Silurian of Eastern Iowa: Iowa Geol. Survey Rept. Inv. 6, 52 p.

Ingels, J. J. C., 1963, Geometry, paleontology, and petrography of Thornton reef complex, Silurian of northeastern Illinois: Am. Assoc. Petroleum Geol. Bull., v. 47, p. 405-440.

Krey, Frank, and J. E. Lamar, 1925, Limestone resources of Illinois: Illinois Geol. Survey Bull. 46, 392 p.

Lapworth, C., 1879, On the tripartite classification of the lower Paleozoic rocks: Geol. Mag., n.s., Decade II, v. 6, p. 1-15.

Lowenstam, H. A., 1942, A Niagaran fauna from the Chicago area with Brownsport and Bainbridge affinities: Buffalo Soc. Nat. Sci. Bull., v. 17, p. 36-39.

Lowenstam, H. A., 1948, Biostratigraphic studies of the Niagaran inter-reef formations in northeastern Illinois: Illinois State Mus. Sci. Papers, v. 4, 146 p.

Lowenstam, H. A., 1949a, Facies analyses of the Niagaran rocks in Illinois: Illinois Acad. Sci. Trans., v. 42, p. 113-115; Illinois Geol. Survey Circ. 157, p. 113-115.

Lowenstam, H. A., 1949b, Niagaran reefs in Illinois and their relation to oil accumulation: Illinois Geol. Survey Rept. Inv. 145, 36 p.

Lowenstam, H. A., 1950, Niagaran reefs of the Great Lakes area: Jour. Geology, v. 58, p. 430-487.

Lowenstam, H. A., 1952, Some new observations on Niagaran reefs in Illinois: Illinois Acad. Sci. Trans., v. 45, p. 100-107; 1953, Illinois Geol. Survey Circ. 183, p. 100-107.

Lowenstam, H. A., 1957, Niagaran reefs in the Great Lakes area, in Paleoecology, H. S. Ladd, ed., Treatise on marine ecology and paleoecology: Geol. Soc. Amer. Mem. 67, v. 2, 215-248.

Lowenstam, H. A., H. B. Willman, and D. H. Swann, 1956, The Niagaran reef at Thornton, Illinois: Illinois Geol. Survey Guidebook Ser. 4, 19 p.

Martin, J. A., K. G. Larsen, and G. A. Muilenburg, 1961, Silurian System, in W. B. Howe and J. W. Koenig (eds.), The stratigraphic succession in Missouri: Missouri Geol. Survey, 2nd ser., v. 40, p. 32-35.

Meek, F. B., and A. H. Worthen, 1868, Paleontology, in A. H. Worthen, Geology and palaeontology: Geol. Survey of Illinois, v. 3, p. 291-565.

Murchison, R. I., 1835, London and Edinburgh Philos. Mag. and Jour. Sci., 3rd ser., v. 7, p. 46-52.

Norton, W. H., 1895, Occurrence of Megalomus canadensis Hall in the Leclaire beds at Port Byron, Illinois: Iowa Acad. Sci. Proc., v. 2, p. 42-43.

Norton, W. H., 1899, Geology of Scott County: Iowa Geol. Survey, v. 9, p. 389-519.

Ostrom, M. E., 1957, Subsurface dolomite and limestone resources of Grundy and Kendall Counties: Illinois Geol. Survey Circ. 230, 25 p.

Ostrom, M. E., 1967, Paleozoic stratigraphic nomenclature for Wisconsin: Wisconsin Geol. and Nat. Hist. Survey. Inf. Circ. 8, chart and text.

Owen, D. D., 1844, Report of a geological exploration of part of Iowa, Wisconsin, and Illinois, made under the direction of the Secretary of the Treasury of the United States in the autumn of the year 1839: U.S. 28th Cong., 1st Session, Senate Exec. Doc. 407, p. 9-191.

Percival, J. G., 1856, Second annual report of the geological survey of the State of Wisconsin: Madison, Wis., 111 p.

Rexroad, C. B., 1970, An outline of Silurian conodont zones in the Illinois Basin and the Cincinnati Arch area, in W. B. N. Berry and A. J. Boucot, eds., Correlation of the North American Silurian rocks: Geol. Soc. America Spec. Paper 102, p. 91-94.

Rexroad, C. B., and R. S. Nicol, 1971, Summary of conodont biostratigraphy of the Silurian System of North America: Geol. Soc. America Memoir 127, p. 207-225.

Ross, C. A., 1962a, Early Llandoverian (Silurian) graptolites from the Edgewood Formation, northeastern Illinois: Jour. Paleon., v. 36, p. 1383-1386; Illinois Geol. Survey Reprint 1963-A, 4 p.

Ross, C. A., 1962b, Silurian monograptids from Illinois: Paleontology, v. 5, pt. 1, p. 59-72; Illinois Geol. Survey Reprint 1962-N, 14 p.

Roy, S. K., and C. G. Croneis, 1931, A Silurian worm and associated fauna: Field Mus. Nat. Hist. Pub. 298, Geol. Ser., v. 4, p. 229-247.

Savage, T. E., 1906, Geology of Jackson County: Iowa Geol. Survey, v. 16, p. 563-648.

Savage, T. E., 1908, On the lower Paleozoic stratigraphy of southwestern Illinois: Am. Jour. Sci., ser. 4, v. 25, p. 431-443; expanded in Illinois Geol. Survey Bull. 8, p. 103-116.

Savage, T. E., 1910, Faunal succession and correlation of the pre-Devonian formations of southern Illinois: Illinois Geol. Survey Bull. 16, p. 302-341.

Savage, T. E., 1912, The Channahon and Essex Limestones in Illinois: Illinois Acad. Sci. Trans. (1911), v. 4, p. 97-103.

Savage, T. E., 1913, Stratigraphy and paleontology of the Alexandrian Series in Illinois and Missouri: Illinois Geol. Survey Extract from Bull. 23, 124 p.; 1917, Illinois Geol. Survey Bull. 23, p. 67-160.

Savage, T. E., 1914, The relations of the Alexandrian Series in Illinois and Missouri to the Silurian section of Iowa: Am. Jour. Sci., ser. 4, v. 38, p. 28-37.

Savage, T. E., 1916, Alexandrian rocks of northeastern Illinois and eastern Wisconsin: Geol. Soc. America Bull., v. 27, p. 305-324.

Savage, T. E., 1926, Silurian rocks of Illinois: Geol. Soc. America Bull., v. 37, p. 513-533.

Savage, T. E., 1942, in C. K. Swartz et al., Correlation of the Silurian formations of North America: Geol. Soc. Amer. Bull., v. 53, chart 3, facing p. 536.

Scobey, E. H., 1938, The Alexandrian Series in Iowa: Jour. Geology, v. 46, p. 207-217.

Shaver, R. H., et al., 1970, Compendium of rock-unit stratigraphy in Indiana: Indiana Geol. Survey Bull. 43, 229 p.

Shaw, James, 1873, Geology of northwestern Illinois; geology of Jo Daviess, Stephenson, Carroll, and Winnebago Counties, in A. H. Worthen, Geology and palaeontology: Geol. Survey of Illinois, v. 5, p. 1-94.

Suter, Max, R. E. Bergstrom, H. F. Smith, G. H. Emrich, W. C. Walton, and T. E. Larson, 1959, Preliminary report on ground-water resources of the Chicago region, Illinois: Illinois Geol. Survey and Illinois State Water Survey Coop. Groundwater Rept. 1, 89 p.

Sutton, A. H., 1935, Stratigraphy of the Silurian System of the upper Mississippi Valley: Kansas Geol. Soc. Guidebook, 9th Ann. Field Conf., p. 268-280.

Swartz, C. K., et al., 1942, Correlation of the Silurian formations of North America: Geol. Soc. America Bull., v. 53, p. 533-538.

Templeton, J. S., and H. B. Willman, 1963, Champlainian Series (Middle Ordovician) in Illinois: Illinois Geol. Survey Bull. 89, 260 p.

Trowbridge, A. C., and E. W. Shaw, 1916, Geology and geography of the Galena and Elizabeth Quadrangles: Illinois Geol. Survey Bull. 26, p. 1-171.

Ulrich, E. O., 1924, Notes on new names in table of formations and on physical evidence of breaks between Paleozoic systems in Wisconsin: Wisconsin Acad. Sci. Trans., v. 21, p. 71-107.

Weller, J. M., 1935, Illinois log and stratigraphic sections: Kansas Geol. Soc. Guidebook, 9th Ann. Field Conf., p. 38-60, 424-427.

Weller, Stuart, 1899, A peculiar Devonian deposit in northeastern Illinois: Jour. Geology, v. 7, p. 483-488.

Weller, Stuart, 1900, The paleontology of the Niagaran Limestone in the Chicago area; the Crinoidea: Chicago Acad. Sci., Nat. Hist. Survey Bull. 4, Pt. I, p. 1-153.

Weller, Stuart, 1907, The paleontology of the Niagaran Limestone in the Chicago area; the Trilobita: Chicago Acad. Sci., Nat. Hist. Survey Bull. 4, Pt. II, p. 161-281.

Willman, H. B., 1943, High-purity dolomite in Illinois: Illinois Geol. Survey Rept. Inv. 90, 89 p.

Willman, H. B., 1944, Resistance of Chicago area dolomites to freezing and thawing: Illinois Geol. Survey Bull. 68, p. 249-262.

Willman, H. B., 1962, The Silurian strata of northeastern Illinois, and Description of stops second day, in Silurian rocks of the southern Lake Michigan area: Michigan Basin Geol. Soc. Ann. Field Conf., p. 61-67, 81-96; Illinois Geol. Survey Reprint 1962-M, 8 p.

Willman, H. B., 1971, Summary of the geology of the Chicago area: Illinois Geol. Survey Circ. 460, 77 p.

Willman, H. B., H. A. Lowenstam, and L. E. Workman, 1950, Field conference on Niagaran reefs in the Chicago region: Illinois Geol. Survey Guidebook Ser. 1, 23 p.

Willman, H. B., and R. R. Reynolds, 1947, Geological structure of the zinc-lead district of northwestern Illinois: Illinois Geol. Survey Rept. Inv. 124, 15 p.

Willman, H. B., D. H. Swann, and J. C. Frye, 1958, Stratigraphy policy of the Illinois State Geological Survey: Illinois Geol. Survey Circ. 249, 14 p.

Willman, H. B., et al., 1967, Geologic Map of Illinois: Illinois Geological Survey.

Wilson, A. G., 1895, The Upper Silurian in northeastern Iowa: Am. Geologist, v. 16, p. 275-281

Winchell, A. N., and Oliver Marcy, 1866, Enumeration of fossils collected in the Niagara Limestone at Chicago, Illinois, with descriptions of several new species: Boston Soc. Nat. Hist. Mem., v. 1, p. 81-113.

Workman, L. E., 1950, The Neda Formation in northeastern Illinois: Illinois Acad. Sci. Trans., v. 43, p. 176-182; 1951, Illinois Geol. Survey Circ. 170, p. 176-182.

Worthen, A. H., 1866, Devonian and Silurian Systems, in A. H. Worthen, Geology: Geol. Survey of Illinois, v. 1, p. 119-152.

Zeizel, A. J., W. C. Walton, R. T. Sasman, and T. A. Prickett, Ground-water resources of Du Page County, Illinois: Illinois Geol. Survey and Illinois State Water Survey, Coop. Ground-Water Rept. 2, 103 p.

GEOLOGIC SECTIONS

NORTHEASTERN ILLINOIS

1. COWAN'S QUARRY SECTION

Exposure in bluff and small abandoned quarry, north side of Kankakee River, 3½ miles southeast of Ritchey, Will Co. (SE SW NW 26, 32N-10E, Herscher Quad.). Type section of the Kankakee Formation.

Silurian System
Joliet Formation
Brandon Bridge Member
Limestone, dolomitic, argillaceous, greenish gray, fine-grained, dense; in beds ½-3" thick; contains thin green shale partings..... 4'
Limestone, dolomitic; like above but locally red; contains many shale partings and forms a shaly reentrant on weathered surfaces..... 1'
Kankakee Formation (17'9")
Plaines Member
Limestone, dolomitic, very light gray, massive, medium-grained, dense; contains many poorly preserved fossil fragments; 3" fossil coquina 10" above base; pitted smooth surface on top; contains Pentamerus and Microcardinalia..... 2' 7"
Troutman Member
Dolomite, argillaceous, gray, fine-grained, dense; in beds ½-2" thick..... 1' 7"
Dolomite, slightly argillaceous, gray, fine- to medium-grained, dense; in beds 1-2" thick; contains thin green clay partings..... 6' 3"
Clay, gray; in lenses, making strong reentrant; 0 to..... 2"
Dolomite, similar to above, but weathers brown; 2" shaly reentrant at base..... 1' 2"
Dolomite, similar to above, but thicker bedded and contains thicker green shale partings; 1'8" to..... 2' 8"
Offerman Member
Dolomite, argillaceous, fine-grained, dense; contains streaks of finely vesicular, crinoidal dolomite; prominent bedding plane at base; 6" to..... 1'
Dolomite, argillaceous, fine-grained, dense to vesicular; in beds 1-3" thick; contains 1" laminated beds at top and 4" below top..... 1'
Drummond Member
Dolomite, weathered reddish brown, medium-grained, glauconitic, massive, vesicular; contains large vugs; small pentamerids common; Platymerella present..... 1' 4"

Ordovician System
Maquoketa Group
Neda Oolite
Oolite, reddish brown; base concealed..... 1' 6"

2. EGGLESTON SECTION

Abandoned quarry on east side of Wiley Creek and exposure in ditch along north side of road, ¼ mile west of Eggleston School, 3 miles northwest of Kankakee, Kankakee Co. (SW SE NE 27, 31N-11E, Kankakee Quad.).

Silurian System
Racine Formation (25'8")
Dolomite, brown, highly vesicular, massive, fossiliferous; contains many crinoid stems; upper 5' has many large vugs; exposed largely in road ditch, lower 3' at top of quarry.....19'
Dolomite, very argillaceous, in part shaly, light brownish gray, weathers buff, thin-bedded; contains wavy, thin, dark gray, lenticular clay partings..... 1'
Dolomite, argillaceous; in beds ¼-2" thick..... 1' 6"
Dolomite, like 1' bed above 8"
Dolomite, like 1'6" bed above; 6" to..... 1' 6"
Dolomite, medium-grained, vesicular, massive, lenticular; 6" to..... 2'
Sugar Run Formation
Dolomite, argillaceous, very fine grained, dense; in 2-8" beds; bedding planes smooth; weathers reddish brown; base concealed at water level..... 5'

3. ELMHURST QUARRY SECTION

Quarry of Elmhurst-Chicago Stone Company in Elmhurst, Du Page Co. (SW NW 2, 39N-11E, Elmhurst 7.5' Quad.).

Devonian System
Joints and pockets filled with a brown shale containing Devonian fossils in the upper part of the Silurian rocks in this quarry were described by Weller (1899) and Alden (1902). None have been found in recent years.

Silurian System
Racine Formation
Dolomite, pure, medium-grained, highly porous, medium to dark gray, massive to faintly bedded; contains many large crinoid stems; the base of this unit, which is a reef, rises rapidly to the east so that the unit thins to 40 feet; as it thins, it grades to dense, argillaceous, cherty interreef rock, except for the uppermost 2-5', which continues over most of the area quarried; 40' to.....60'
Dolomite, silty, argillaceous, very fine grained, dense, light brownish gray to greenish gray; in beds 3-6" thick; contains many thin, wavy, green clay partings; this unit has the same lithology as the overlying beds that grade laterally to the reef; base of Racine is 80-90' below top of quarry; 25' to..45'
Sugar Run Formation
Dolomite, light brownish gray; argillaceous and silty at top but grades to only slightly impure at base; similar to above but more massive and contains little chert.....10'
Joliet Formation (81'3")
Romeo Member
Dolomite, pure, light gray, in part mottled medium to dark gray, vesicular; in 3-10" beds with tight, stylolitic, bedding planes.....34'
Markgraf Member
Dolomite, slightly argillaceous at top to silty at base; contains scattered chert nodules.....28' 3"
Brandon Bridge Member
Dolomite, argillaceous, dense, fine-grained, gray at top; red silty beds at base; contains green shale partings.....19'
Kankakee Formation (46'6")
Plaines Member
Dolomite, pure, white, massive; smooth surface with pits filled with green clay on top..... 2'
Troutman Member
Dolomite, pinkish gray, slightly vesicular; in thin beds with green shale partings; thin lenses of nearly white clay along prominent reentrant 13'4" above base.....29' 4"
Offerman Member
Dolomite, similar to above, but dense and more argillaceous..... 9' 2"
Drummond Member
Dolomite, pure, gray, vesicular, massive..... 6'
Covered to quarry floor, which is on the top of the Ordovician Brainard Shale 3'

4. HILLSIDE QUARRY SECTION

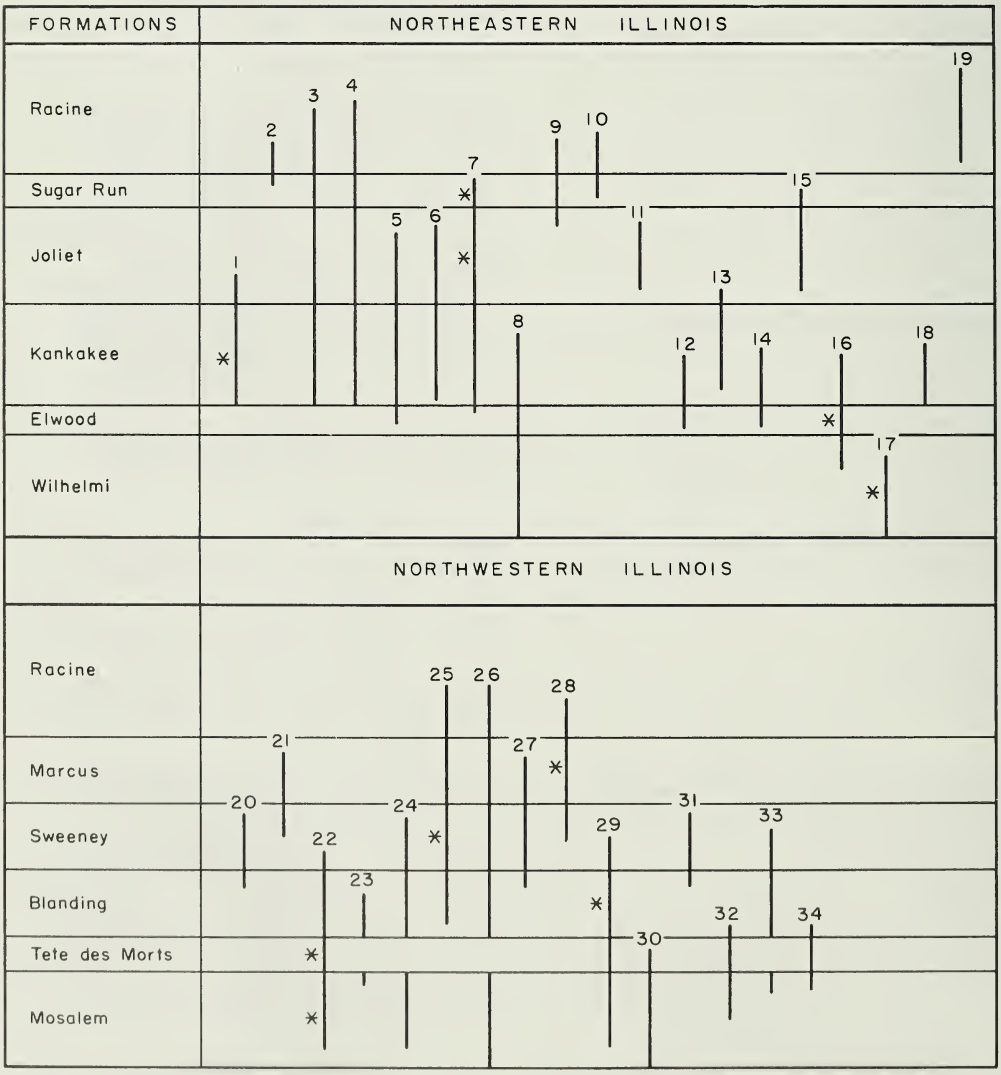
Quarry of Consumers Company in Hillside, Cook Co. (SE NE 17, 39N-12E, Hinsdale Quad.). Summary of section.

Silurian System
Racine Formation
Dolomite, pure, light gray, massive, vesicular; weathered brown.....15' 6"
Dolomite, cherty, slightly argillaceous and silty, brownish to greenish gray.....80'
Sugar Run Formation
Dolomite, silty, greenish gray; contains dark green, wavy, argillaceous partings; contains lenses of chert; lower 6' transitional to below.....29'
Joliet Formation (71')
Romeo Member
Dolomite, pure, gray, partly mottled pink; in 6-12" beds.....26'
Markgraf Member
Dolomite, slightly argillaceous, light brownish gray, dense; contains scattered chert nodules.20'
Brandon Bridge Member
Dolomite, argillaceous, greenish gray, locally pinkish; contains strong green shale partings.25'
Kankakee Formation (32'5")
Plaines Member
Dolomite, pure, white, massive; pitted smooth surface on top..... 2' 5"
Troutman Member
Dolomite, greenish and pinkish gray; in thin beds with green shale partings..... 17' 3"
Offerman Member
Dolomite, slightly argillaceous, dense, thin-bedded..... 8' 9"
Drummond Member
Dolomite, pure, gray, vesicular; base concealed at water level in sump..... 4'

5. JOLIET—LINCOLN QUARRY SECTION

Quarry of the Lincoln Stone Company south of Brandon Bridge, southwest of Joliet, Will Co. (S½ SE 20 and N½ NE 29, 35N-10E, Elwood 7.5' Quad.). Type section of the Brandon Bridge Member of the Joliet Formation.

Silurian System
Joliet Formation (54'7")
Romeo Member



*Type section.

Fig. 10 - Index to stratigraphic units described in the geologic sections.

Dolomite, pure, light gray, fine-grained, vesicular; in beds 2-6" thick..... 3' 2"

Markgraf Member

Dolomite, slightly argillaceous, light gray, slightly vesicular; in beds 2-4" thick; slightly shaly zones occur 1'9" below top and 6" above base; chert nodules scattered throughout and in six bands..... 11' 8"

Dolomite, silty, light gray, dense, very fine grained; many wavy argillaceous partings show on weathered surface; in beds 2-8" thick; contains scattered chert nodules, zones crowded with chert nodules 1'4"-1'10" and 2'10"-3'4" below top, and prominent bifurcating band of chert 4'4"-4'8" below top..... 6'

Dolomite, as above, but very silty; not cherty as in the National and Markgraf quarries; prominent bedding plane at base..... 2' 1"

Dolomite, as above, but massive; weathers to 4"-1'6" beds..... 6' 8"

Brandon Bridge Member

Dolomite, argillaceous and silty, gray, mottled pink and green; contains thin lenses of green clay; shaly near base..... 6'10"

Dolomite, as above, but very argillaceous and contains many strong green shale partings.... 2' 8"

Shale, dolomitic, black and green interbedded and mottled or in places all green; grades to argillaceous finely laminated dolomite; 0 to. 1'

Dolomite, pink to red, fine- to medium-grained, dense to slightly vesicular; in beds 1-2" thick separated by beds of green shale or green and pink mottled argillaceous dolomite. 14' 6"

Kankakee Formation (49'9")

Plaines Member

Dolomite, very light gray, medium-grained, vesicular; in one ledge; pitted smooth surface on top; Pentamerus oblongus abundant in local pockets..... 2' 2"

Troutman Member

Dolomite, as above, but has thin green shale partings..... 9"

Dolomite, light gray, slightly pinkish, fine- to medium-grained, dense to finely vesicular; in beds 1-2" thick separated by thin green clay partings; Microcardinalia abundant in 6" beds 3'10" below top..... 26'

Offerman Member

Dolomite, gray, dense, fine-grained, slightly argillaceous, thin-bedded..... 11' 8"

Drummond Member

Dolomite, pure, gray, vesicular, massive, glauconitic; lower 2' cherty and contains Platymerella..... 9' 2"

Elwood Formation

Dolomite, dense, brownish gray, very cherty; contains Platymerella in upper 2'; base at quarry floor..... 12' 4"

The lower 40' of this section was exposed in a lower bench now filled with cinders.

6. JOLIET—MARKGRAF QUARRY SECTION

Abandoned Markgraf quarry on north side of Des Plaines River Valley, in southwest part of Joliet, Will Co. (SW SW 16, 35N-10E, Joliet 7.5' Quad.). Type section of the Markgraf Member of the Joliet Formation.

Silurian System

Joliet Formation (64'7")

Romeo Member

Dolomite, pure, gray, fine-grained, vesicular; in beds 2-4" thick; contains a few silicified fossils..... 7' 1"

Dolomite, as above, but contains chert nodules largely in five bands..... 4' 5"

Dolomite, as above, but without chert; prominent wavy bedding plane at base..... 5' 6"

Markgraf Member

Dolomite, slightly argillaceous, light brownish gray, fine-grained, slightly vesicular; in beds 2-8" thick; contains slightly shaly zone 1'7" from top; chert nodules in five discontinuous bands..... 6' 2"

Dolomite, slightly more argillaceous than above; contains prominent band of large white chert nodules in the middle and a lenticular bed of chert at the base..... 2'11"

Dolomite, silty and argillaceous, light gray, very fine grained, dense; in beds 1/4-8" thick; contains light green wavy clay partings and thin shaly zones 9" and 4' below top; small chert nodules are closely spaced in zones 9-12", 2'6"-2'11", and 3'11"-4'4" below top..... 4' 4"

Dolomite, as above, but more silty; contains scattered nodules of chert and a persistent band of chert nodules below top..... 4' 5"

Dolomite, silty, very light gray, dense, very fine grained; massive on fresh surfaces but weathers into three ledges..... 4' 3"

Brandon Bridge Member

Dolomite, argillaceous and silty, gray, mottled light pink and green; contains many wavy argillaceous partings; 2" shaly zone 1'8" below top..... 6' 9"

Dolomite, as above, but less shaly and has smoother weathered surface..... 2'10"

Dolomite, as above, but very shaly; grades westward to a 2-4" shale bed..... 5"

Dolomite, mottled and interbedded red, green, and gray; the red dolomite is mostly fine to medium grained and relatively pure; the green dolomite and most of the gray are argillaceous and silty; contains many green shale partings.....15' 6"

Kankakee Formation

Plaines Member

Dolomite, pure, white, vesicular, massive; contains Microcardinalia; top surface is smooth and has deep pits filled with green clay..... 1' 6"

Troutman, Offerman, and Drummond Members

Dolomite, light pinkish or greenish gray, fine-grained; low to medium vesicularity; in beds mostly 2-3" thick separated by thin green clay partings; bedding planes very wavy; contains chert in lenses near base.....38'

The lower 45' of this section is now covered by water and fill.

7. JOLIET—NATIONAL QUARRY SECTION

Quarry of National Stone Company on south side of Joliet, Will Co. (NE SE 21, 35N-10E, Joliet 7.5' Quad.). Type section of the Joliet and Sugar Run Formations and the Romeo Member of the Joliet Formation.

Silurian System

Sugar Run Formation

Dolomite, silty, argillaceous, gray, brown weathering, very fine grained, dense; in beds mostly 4"-1' thick; bedding planes smooth with thin shaly partings; generally noncherty, but bands of white chert occur about 8' below top near a clay pocket in south face; insoluble residue increases upward from 10%-20%.....18'

Dolomite, slightly argillaceous and silty, very fine grained, dense, light gray weathering at top; grades downward to fine-grained, low to medium vesicular, gray weathering dolomite at base; insoluble residue 3%-8%; transition zone to Joliet Formation..... 8' 4"

Joliet Formation (67'10")

Romeo Member

Dolomite, pure, light gray, fine-grained, vesicular (1" vugs common), fossiliferous; in beds 6"-2' thick; bedding planes tight, rough, in part stylolitic; locally contains thin green clay partings; 1%-2% insoluble residue..... 6'

Dolomite, as above, but very cherty; contains

silicified fossils and chert in 6-15 discontinuous bands of closely spaced nodules and lenses..... 9' 3"
Dolomite, as above, but massive and locally has light pink mottling..... 4'11"

Markgraf Member

Dolomite, very light gray, very fine grained, dense to slightly vesicular; slightly less pure than overlying beds; faint, very thin argillaceous streaks show on weathered surfaces; in beds 2-10" thick; chert nodules scattered throughout, but most abundant in seven discontinuous bands; 3%-4% insoluble residue..... 11' 4"
Dolomite, silty, light gray, very fine grained, dense; contains green argillaceous lenses, silicified fossils, and scattered chert nodules mostly in six bands; 9%-12% insoluble residue..... 8' 2"
Dolomite, silty, light gray, locally pink mottled, massive, noncherty; 10% insoluble residue..... 5'

Brandon Bridge Member

Dolomite, silty, argillaceous, gray, pink and green mottled, 2" gray laminated bed 11" below top; thin shaly partings prominent on weathered surface; 10%-15% insoluble residue. 3'
Dolomite, as above, but very silty; weathered surface smooth..... 3' 2"
Dolomite, as above, but darker colored; contains many green shale partings; base concealed..... 3' 8"
To quarry floor..... 6'
Shale, green; 0 to..... 4"
Summary of section in lowest bench
Dolomite, argillaceous, gray, red, green, thin-bedded..... 13'

Kankakee Formation (38'7")

Plaines Member

Dolomite, pure, white, massive; pitted smooth surface on top..... 3' 4"

Troutman Member

Dolomite, greenish and pinkish gray, vesicular; in thin wavy beds separated by green clay partings..... 18' 6"

Offerman Member

Dolomite, similar to above, but slightly argillaceous..... 5' 9"

Drummond Member

Dolomite, gray, vesicular, massive, glauconitic; contains corals and a few rounded quartz sand grains..... 11'

Elwood Formation

Dolomite, brownish gray, cherty; Platymerella manniensis in chert; base concealed at quarry floor..... 1'

8. KANKAKEE RIVER CAMPGROUND SECTION

Outcrop, north side of Kankakee River, 3/4 mile west of Warner Bridge, at campground of Kankakee River State Park, 5 miles southeast of Ritchey, Will Co. (NE NW SW 36, 32N-10E, Herscher Quad.).

Silurian System

Kankakee Formation (19'8")

Troutman Member

Dolomite, light brownish gray, fine-grained, dense to slightly vesicular; in 4-8" beds; prominent bedding plane at base..... 5'
Dolomite, similar to above but slightly more argillaceous; in 1-3" beds with thin wavy partings of green clay 5' 6"

Offerman Member

Dolomite, argillaceous, yellowish brown, very fine grained, dense; in 3-8" beds..... 3'10"

Drummond Member

Dolomite, brownish gray to brown, medium-grained, massive, dense to highly vesicular (contains large vugs); upper 2" locally laminated; large lenses of chert along base; 1' to..... 1' 8"
Dolomite, similar to above, but well-bedded and uniformly highly vesicular; contains dolomite lenses consisting largely of casts of a small pentamerid..... 2' 3"
Dolomite, reddish brown, highly vesicular; in single bed; 7" to..... 1' 4"
Conglomerate, light gray to black nodules or pebbles as large as 1" in diameter; possibly algal; ¼" to..... 1"

Wilhelmi Formation (10½")

Dolomite, very argillaceous and shaly; contains scattered oolites..... ½"
Dolomite, brown, dense, hard, laminated; 2" to. 3"
Dolomite, very argillaceous, soft; contains pockets of dark brown oolites..... 4"
Dolomite, laminated; 2" to..... 3"

Ordovician System

Maquoketa Group

Neda Oolite

Oolite, reddish brown, locally conglomeratic; in thin to 6" thick beds; some beds have dark green clay matrix; oolites hematitic and flattened; a 6-10" hard ledge 6" below top is dark red and has concretionary structure.. 3' 2"
Shale, purple and green; upper 2-6" is oolitic. 8"
Shale, purple, partly green mottled; base concealed..... 6"

9. LEHIGH QUARRY SECTION

Quarry of Lehigh Stone Company at Lehigh, 8 miles west of Kankakee, Kankakee Co. (NE 7, 30N-11E, Herscher and Kankakee Quads.).

Silurian System

Racine Formation (76'1½")

Dolomite, light gray, fine-grained, dense, slightly to moderately argillaceous; mostly in 1-6" even beds..... 13' 2"
Dolomite, as above, but in 2-4" wavy beds, which give a nodular appearance; strong shaly reentrant at base..... 6'
Dolomite, gray, slightly argillaceous, dense; in 6"-1' even beds with shaly partings in lower part..... 6' 4"
Dolomite, light gray, dense, laminated; 1" to.. ?"
Dolomite, light gray, mottled pink, slightly argillaceous; in 3"-1'6" beds; large vugs at top..... 7' 2"
Shale, green; makes persistent reentrant..... ½"
Dolomite, light gray, mottled pink, slightly argillaceous; in 3"-1' beds with strong green clay partings..... 8'
Dolomite, as above, but interbedded with green shale; 1" to..... 3"
Dolomite, light gray, mottled pink, argillaceous; contains closely spaced dark gray shaly zones; in 8"-2' beds with clay partings..... 35'

Sugar Run Formation

Dolomite, white, slightly argillaceous, slightly vesicular; in 8"-2' beds, most with smooth bedding planes, but some bedding planes are stylolitic..... 20'

Joliet Formation

Romeo Member

Dolomite, white, pure, fine-grained, moderately vesicular with a few large vugs; in 4-8" beds with stylolitic bedding surfaces; base concealed at quarry floor..... 10'
Drilling in the quarry floor showed 35' of dolomite to the shale of the Maquoketa Group, and samples from a well near the crushing plant indicate that the interval consists of 12' of Joliet, 18' of Kankakee, and 5' of Millsdale, thicknesses comparable to those in exposures along the Kankakee River, 8 miles north.

10. LEMONT BLUFF SECTION

Abandoned quarry and ravine above it in the south bluff of the Des Plaines Valley on

the east side of Lemont, Cook Co. (W½ 21, 37N-11E; Sag Bridge 7.5' Quad.).

Silurian System
Racine Formation (59')

Dolomite, pure, gray, light brown weathering, medium-grained, vesicular; massive where fresh but weathers to 1-3" beds; contains thin lenticular films of green clay on bedding planes and scattered chert nodules in lower 3'; prominent shaly bedding plane at base..... 17' 6"
Dolomite, similar to above but better bedded; contains chert in lower 6"; prominent shaly bedding plane at base..... 2' 2"
Dolomite, mostly argillaceous, silty, fine-grained, dense; contains a few beds that are pure and vesicular; chert abundant in scattered nodules and bands of nodules; in beds mostly ¼-4" thick..... 8' 6"
Section above measured in ravine above west end of quarry.
Dolomite, similar to above but thinner bedded and contains a large concentration of chert nodules, which gives it a conglomeratic appearance..... 12'
Dolomite, silty, argillaceous, fine-grained; contains scattered chert nodules; in 4-8" beds..... 6' 3"
Dolomite, very argillaceous, fine-grained; contains lenses of green shale on rough-surfaced bedding planes, several 3-6" beds of medium-grained relatively pure dolomite, and much chert in scattered nodules and beds..... 8' 6"
Dolomite, argillaceous, fine-grained, dense; contains green clay lenses that give a mottled appearance..... 10"
Dolomite, slightly argillaceous, fine-grained; crowded with chert nodules..... 1' 9"
Dolomite, like 10" bed above..... 6"
Dolomite, pure, medium-grained..... 1"
Dolomite, like 10" bed above..... 9"
Chert, laminated, persistent layer..... 2"

Sugar Run Formation (11'3")

Dolomite, light gray, silty, argillaceous, dense; in beds 4-8" thick; contains chert lenses in upper part..... 3' 4"
Dolomite, as above, but not cherty; in 6"-1' beds..... 4' 7"
Dolomite, as above, but single massive ledge; base concealed at water level..... 3' 4"

11. LEMONT WEST QUARRY SECTION

Quarry of Lemont Stone Co. (R. P. Donohoe Co., Inc.) excavated for a boat slip, 1 mile west of Lemont, Cook Co. (SW SW 19, 37N-11E, Romeoville 7.5' Quad.).

Silurian System
Joliet Formation (51')
Romeo Member

Dolomite, pure, light gray, slightly vesicular; in 4-8" beds..... 3'
Dolomite, pure, light gray, vesicular; in 1-2' beds; contains 6" band of white chert nodules at base..... 12'
Dolomite, pure, light and medium gray, vesicular, massive..... 5'

Markgraf Member

Dolomite, slightly argillaceous, light gray, slightly vesicular; contains chert nodules in bands at base and 1' and 2' above base and scattered above; in 1-2' beds..... 11'
Dolomite, argillaceous, light yellowish gray, dense; contains a few chert nodules; in 1-2" beds..... 7'

Brandon Bridge Member

Dolomite, light gray, slightly pinkish, fine-grained, slightly vesicular; contains a few thin green clay partings..... 3'
Dolomite, light pink with greenish shale lenses; base concealed at water level..... 10'
Dolomite, dark red, argillaceous; excavated from below water level

12. NORTH AURORA QUARRY SECTION

Conco Western Stone Company quarry on the east side of the Fox River Valley, south of North Aurora, Kane Co. (SE SW 3, 38N-8E, Aurora North 7.5' Quad.).

Silurian System
Kankakee Formation

Dolomite, pure, fine-grained, vesicular; in 1-3" wavy beds with green shale partings; weathered brown..... 13'

Drummond Member

Dolomite, pure, gray; in 1-3' beds; contains large vugs; strong shaly partings at base.... 8'

Elwood Formation

Dolomite, slightly argillaceous, very fine grained, dense to slightly vesicular; in beds mostly 8"-1' thick; greenish clay streaking; contains white chert in layers and bands of nodules as much as 4" thick; base concealed at quarry floor..... 20'

13. PLAINES EAST SECTION

Abandoned quarry at Plaines Station (railroad switching area), south side of the Des Plaines River, 1½ miles southwest of Brandon Bridge, Will Co. (SW NW SE 30, 35N-10E, Channahon 7.5' Quad.). Type section of Plaines Member and (with nearby Plaines West) the Troutman Member of the Kankakee Formation.

Silurian System
Joliet Formation
Brandon Bridge Member

Dolomite, pink and gray, medium-grained, dense; contains green clay partings; exposed at east end of quarry..... 2' 6"

Kankakee Formation (22'9")
Plaines Member

Dolomite, very light gray, fine-grained, vesicular, massive, fossiliferous; upper surface is smooth but contains pits filled with green clay..... 2' 2"

Troutman Member

Dolomite, light brownish and pinkish gray, fine- to medium-grained; in 1-4" wavy beds; contains thin green shale partings..... 19'
Clay, very light gray; in pockets on wavy bedding plane; makes reentrant..... 1"
Dolomite, light gray, fine-grained, dense, slightly argillaceous; base concealed at quarry floor..... 1' 6"

14. PLAINES WEST SECTION

Railroad cut southwest of Plaines Station, south side of the Des Plaines River, 1 3/4 miles southwest of Brandon Bridge, Will Co. (NW SE SW 30, 35N-10E, Channahon 7.5' Quad.), ¼ mile southeast of Plaines East section. Type section of the Troutman (lower part), Offerman, and Drummond Members of the Kankakee Formation.

Silurian System
Kankakee Formation (22'10")
Troutman Member

Dolomite, brownish gray, buff weathering, fine- to medium-grained, dense; in 1-4" wavy beds with green shale partings..... 3' 6"
Clay, very light gray, locally white and flaky; in pockets along a rough-surfaced bedding plane..... 1"
Dolomite, slightly argillaceous, light brownish gray, mostly fine-grained; glauconite generally rare but present in a few beds; in 1-4" beds with thin film of green clay on bedding surfaces, except for the upper 1' which is massive; contains 1-2" beds with fine laminations on weathered surfaces..... 8' 3"

Offerman Member

Dolomite, argillaceous, very light gray, dense; in 1-2" beds that weather lighter and smoother than above..... 2' 6"

Drummond Member

Dolomite, glauconitic, light gray, medium-grained, dense to vesicular; vugs as large as 6" in diameter common; massive, but weak beds 2-8" thick shown on weathered surfaces; contains large chert nodules in lower 1' and rarely in middle, a few rounded grains of quartz sand, and large corals and stromatoporids, mostly silicified; Platymerella is locally abundant in lower 6"..... 8' 6"

Elwood Formation

Dolomite, argillaceous, light brownish gray, very fine grained, dense to slightly vesicular; in beds ½-4" thick; some beds weather slightly shaly; contains white chert in nodules and layers as much as 6" thick; glauconite present but rare; corals common in chert near top; base concealed.....10' 6"

15. ROCK CREEK CANYON SECTION

Outcrops on the west side of Rock Creek and south of the bridge of Illinois Highway 102, in Kankakee River State Park, 6 miles northwest of Bourbonnais, Kankakee Co. (SW SE SW 32, 32N-11E, Kankakee Quad.).

Silurian System

Sugar Run Formation (12'6")

Dolomite, argillaceous, silty, yellowish brown, very fine grained, dense; in 4"-1' beds..... 3' 8"

Dolomite, as above, but weathers shaly..... 7"

Dolomite, as above, but less argillaceous and silty; a few beds slightly vesicular..... 4' 6"

Dolomite, brownish gray to brown, fine-grained, slightly vesicular; in 3"-1' beds; contains a few slightly argillaceous beds; prominent bedding plane at base..... 3' 9"

Joliet Formation (40'1")

Romeo Member

Dolomite, pure, light gray, fine-grained, vesicular, vuggy; in 2-8" beds..... 5' 8"

Dolomite, as above but light brownish gray, less vuggy, and more massive..... 4' 9"

Dolomite, light brownish gray; less vesicular and slightly less pure than above; chert nodules 1' below top..... 7' 6"

Markgraf Member

Dolomite, slightly argillaceous, light brownish gray, very fine grained, dense to slightly vesicular; in weak 8"-1'6" beds..... 7' 6"

Dolomite, slightly argillaceous, light brownish gray, very fine grained, dense to slightly vesicular; in weak 8"-1'6" beds..... 7' 6"

Dolomite, slightly argillaceous, very light gray, very fine grained, dense to slightly vesicular; in 4"-1' beds; faint light green and light pink mottling in lower 1', prominent bedding plane at base..... 4' 9"

Brandon Bridge Member

Dolomite, light greenish gray, very fine grained, dense; contains a few coarse-grained, pinkish lenses..... 6"

Dolomite, as above, but more shaly and contains bright green shale partings..... 7"

Dolomite, gray, green and pink mottled, very fine grained, dense; in 2-8" beds with green shale partings; base concealed at low water level..... 1' 4"

The section is cut by a fault at the south side of the bridge; the north side of the fault is down about 6 feet.

16. SCHWEIZER NORTH SECTION

Railroad cut at culvert-marker 43A and outcrops along a ravine extending southeast from the railroad, on the southeast side of the Des Plaines Valley, 3 miles southwest of Brandon Bridge, Will Co. (NW NW SE 36, 35N-9E, Channahon 7.5' Quad.). Type section of Elwood Formation and Birds Member of Wilhelmi Formation.

Silurian System

Kankakee Formation

Troutman and Offerman Members

Dolomite, light brownish gray, fine-grained, dense to slightly vesicular; in wavy 2-6" beds with thin green clay partings; lower beds more argillaceous than higher; partly covered.....18'

Drummond Member

Dolomite, light brownish gray, medium-grained, dense to vesicular, vuggy, strongly glauconitic, massive; contains silicified corals.... 5' 6"

Covered..... 4'

Elwood Formation

Dolomite, argillaceous, yellow-buff, very fine grained, dense, in 1-4" beds; contains chert in scattered nodules and layers, especially abundant in higher beds; only a few scattered nodules of soft chert in lower 3 feet; partly covered.....27'

Wilhelmi Formation (13'10")

Birds Member

Dolomite, slightly argillaceous, light gray, dense; alternating thin beds fine- and medium-grained, giving a faintly laminated appearance on weathered surfaces..... 3"

Dolomite, slightly argillaceous, brownish gray, dense to slightly vesicular..... 3' 9"

Dolomite, laminated bed like 3" bed above..... 3"

Dolomite, fine-grained and slightly vesicular at top; argillaceous, very fine grained, and faintly laminated at base; in 1-2" beds..... 2'

Dolomite, laminated bed..... 4"

Dolomite, argillaceous, very fine grained, slightly vesicular..... 2' 6"

Dolomite, laminated bed..... 3"

Dolomite, argillaceous, brownish gray, very fine grained, dense; in 2-6" beds; base concealed..... 4' 6"

17. SCHWEIZER WEST SECTION

Railroad cut along lower tracks on the southeast side of the Des Plaines Valley, 2 miles north of Millsdale, Will Co. (SE SW SE 35, 35N-9E, Channahon 7.5' Quad.). Type section of the Wilhelmi Formation and the Birds and Schweizer Members of the Wilhelmi Formation.

Silurian System

Wilhelmi Formation (31'9")

Birds Member

Dolomite, slightly argillaceous and silty, gray, weathers yellowish brown; in 2-6" beds; a few beds are more pure, slightly vesicular, fossiliferous; fragments of laminated dolomite like that in the lower part of the Birds in the Schweizer North Section occur at the top..... 5'

Schweizer Member

Dolomite, highly argillaceous, silty, gray, brown weathering, very fine grained, dense; interbedded with dolomitic shale; massive on fresh surfaces but weathers shaly; fossils common in a few of the more dolomitic beds 14' 6"

Shale, dolomitic, medium to dark gray, brown weathering..... 5' 6"

Shale, as above, but contains 1-2" beds of very argillaceous dolomite..... 3' 3"

Dolomite, very argillaceous and silty; in 1-2" beds..... 8"

Dolomite, very argillaceous and silty, finely laminated; upper 4" shaly..... 2' 4"

Dolomite, conglomeratic..... 6"

Ordovician System

Maquoketa Group

Brainard Shale

Shale, green; partly covered.....15'

Fort Atkinson Limestone

Limestone, argillaceous, fine-grained, and limestone, pure, coarse-grained, fossiliferous; contains shaly partings; broken and faulted at contact with Brainard Shale above; base concealed..... 8'

18. SOUTH ELGIN SECTION

Quarry of Fox River Stone Company north of Fox River, 1 mile southwest of South Elgin, Kane Co. (NE NW SW 3, 40N-8E, Geneva 7.5' Quad.), and outcrop ½ mile south along the ravine south of Silver Glen School on the west side of the Fox River (NE NE NE 9).

Silurian System

Kankakee Formation (25'3")

Dolomite, gray and pinkish gray, fine- and medium-grained; in 1-2" wavy beds with thin green clay partings; contains a few scattered chert nodules and silicified corals..... 9' 6"

Clay, light gray to white; makes prominent re-entrant; 0 to..... 1"

Dolomite, as above, but in thicker beds; strong green shale partings at base..... 1'

Dolomite, as above; contains white chert nodules in 2" band 3" above base; strong shaly partings at base..... 1' 8"

Dolomite, as above but thinner bedded and more shaly; 2-4" layers of white chert 1'6" below top; base concealed in quarry, but shale of the Maquoketa Group was encountered in sump only a few feet lower..... 9'

The above unit with the chert layer near the top forms the upper 9' of the exposure at Silver Glen School, where it overlies dolomite, as above but containing several 6-8" beds and a few thin laminated beds..... 4'

Ordovician System

Maquoketa Group

Brainard Shale

Shale, greenish gray; contains beds of fossiliferous limestone up to 6" thick; base concealed.....10'

19. Thornton Quarry Section

Exposures in south part of the south quarry of the Material Service Corporation (General Dynamics Corp.) at Thornton, Cook Co. (N½ SE 33, 36N-14E, Calumet City 7.5' Quad.).

The north quarry and the north part of the south quarry are located in a large Racine reef consisting of light to medium, dark gray mottled, medium-grained, highly vesicular, fossiliferous, pure dolomite that in places contains asphaltum in the small pores and larger vugs. At a depth of about 150' the quarry is still in reef rock. Reef-flank beds dip steeply away from the more massive central part of the reef. The south quarry, separated from the north by only a roadway, exposes reef-flank beds in its north face, the beds dipping south at 30-40 degrees. Farther south, the beds flatten rapidly and contain tongues of impure interreef deposits. Small fore-reefs occur in the interreef deposits near the reef flank. Only interreef deposits are exposed in the south face. The interreef deposits are stratigraphically higher than the reef to the north, but they are probably contemporaneous with higher parts of the reef, which have been eroded. The section of interreef deposits exposed in the south face follows:

Silurian System

Racine Formation (48'9")

Dolomite, argillaceous, brownish gray, fine-grained, slightly vesicular; in 4"-1' beds... 5'

Dolomite, pure, gray, medium-grained, massive; crowded with horn corals; many fossils silicified; 0 to..... 1' 8"

Dolomite, argillaceous; contains lenticular shale partings; 0 to..... 1' 6"

Dolomite, shaly, light gray..... 8"

Dolomite, fine-grained, slightly vesicular; contains thin shale partings near top and chert nodules in lower part..... 1' 4"

Dolomite, argillaceous; contains lenticular shale partings; very shaly at base..... 10"

Dolomite; beds are slightly vesicular and relatively pure in center but grade to dense and argillaceous at bedding planes; in beds 2"-1' thick; silicified corals common..... 5'

Dolomite, cherty, fossiliferous; corals common; transitional from well-bedded dolomite above to nodular shaly dolomite below..... 2' 3"

Dolomite, argillaceous, very fine grained, contains lenticular partings of green shale at about ½" intervals which give a nodular appearance when weathered; grades laterally to shale containing dolomite nodules; contains chert in upper 2'..... 9' 6"

Dolomite, gray, medium-grained, vesicular; contains asphaltum; weathers brown..... 6"

Dolomite, like 9'6" unit above; locally grades to nodules in shale..... 4' 3"

Shale, green, ½" to..... 1"

Dolomite, highly varied; at places a massive reef-type dolomite with large vugs, many containing asphaltum; contains masses of brown weathering, slightly argillaceous dolomite and large silicified corals; changes laterally to a dolomite in which the argillaceous rock predominates and the reef rock occurs as boulders and lenses, forming a breccia or a conglomerate of reef detritus; upper 6" is a distinctive bed of fine- to medium-grained, brown weathering, uniformly vesicular dolomite..... 8' 6"

Dolomite, greenish gray, very argillaceous; gradational to beds above; prominent shaly bedding plane at base; 0 to..... 8"

Dolomite, greenish gray, very argillaceous, very fine grained, dense; contains thin shaly partings at 1-2" intervals; base concealed at quarry floor..... 7'

20. CAMP CREEK QUARRY SECTION

Quarry near mouth of Camp Creek, 2.5 miles northeast of Savanna, Carroll Co. (SE NE SE 25, 25N-3E, Savanna Quad.).

Silurian System

Sweeney Formation (40')

Dolomite, brown, fine-grained, vuggy; in 1-2' beds with weak green clay partings; contains many corals..... 10'

Dolomite, pinkish gray, fine-grained, vesicular; in 2-3" wavy beds with green clay partings; contains silicified corals; Microcardinalia in lower 3'..... 8'

Dolomite, as above, but contains fewer green clay partings; contains chert nodules and lenses in upper 5'; Microcardinalia in upper 1'..... 21'

Dolomite, as above, but contains many strong green clay partings..... 1'

Blanding Formation

Dolomite, gray, fine-grained, dense to finely vesicular; in 4-6" tight beds; contains several 2-6" layers of dense white chert; base concealed at quarry floor..... 5'

21. FULTON QUARRY SECTION

Quarry on north side of Fulton, Whiteside Co. (cen. NE SW 21, 22N-3E, Clinton NW 7.5' Quad.).

Silurian System

Marcus Formation

Dolomite, buff, very porous, soft, massive; in 5-10' ledges; Pentamerus near base..... 25'

Sweeney Formation (22')

Dolomite, mottled light and dark buff; less porous than above; contains few corals; massive except for traces of 2-4" beds with green clay partings..... 8'

Dolomite, brownish gray; contains many large vugs; corals abundant; massive, with traces of thin bedding..... 9'

Dolomite, brownish gray, gray weathering; contains many corals; beds mostly 2-3" thick with green shale partings; base concealed at quarry floor..... 5'

22. KING SECTION (IOWA)

Roadcut of U.S. Highways 52 and 67 about 1/3 mile long, extending south from the village of King, Dubuque County, Iowa (E½ SE 27, 88N-3E, Menominee 7.5' Quad.). Type sections of Tete des Morts and Mosalem Formations.

Silurian System

Sweeney Formation (Lower Hopkinton in Iowa)

Dolomite, gray and pinkish gray, vesicular, tight 2-4" wavy beds with green shale partings; contains silicified corals..... 10'

Blanding Formation (Kankakee in Iowa) (58')

Dolomite, gray, fine-grained, slightly vesicular; in 2-6" beds containing white chert nodules; interbedded with 2-4" layers of white chert; about 30% chert; contains silicified corals..... 52'

Dolomite, brownish gray, very fine grained, dense, slightly argillaceous; in smooth-surfaced 4-8" beds; contains a few scattered chert nodules; "lower quarry beds" of Calvin and Bain (1900)..... 6'

Tete des Morts Formation (member of Edgewood Formation in Iowa) (24'2")

Dolomite, pure, gray, massive; contains glauconite, silicified corals, and thin lenses of white chert..... 6'

Dolomite, as above, but contains chert nodules. 1' 2"

Chert; nearly continuous bed of chert nodules.. 2"

Dolomite, as above..... 10"

Dolomite, as above, massive, not cherty; strong bedding reentrant at base..... 16'

Mosalem Formation (member of Edgewood Formation in Iowa) (61'6")

Dolomite, similar to above, but has weak bedding..... 1' 6"

Dolomite, gray, slightly vesicular; contains thin argillaceous streaks and laminations; bedding stronger than above; strong bedding reentrant at base..... 1' 6"

Dolomite, slightly argillaceous; in 2-6" beds; contains scattered chert nodules..... 6' 6"

Dolomite, argillaceous, dense; in 2-6" beds; contains many bands of chert nodules..... 16'

Dolomite, very argillaceous; interbedded with shaly dolomite; in 6"-1' beds; base concealed..... 36'

23. LANARK NORTHWEST SECTION

Quarry 4 miles northwest of Lanark, Carroll Co. (SW SW SW 14, 25N-5E, Mt. Carroll Quad.).

Silurian System

Blanding Formation (31')

Dolomite, gray, slightly pinkish, fine-grained; dense but has vesicular areas; in 3-5" wavy beds with green partings; contains many 2-5" layers and lenses of white chert (25% chert). 20'

Dolomite, as above; contains only a few discontinuous chert layers..... 7'

Dolomite, as above; contains one chert layer at base and chert nodules locally at top..... 4'

Mosalem Formation

Dolomite, argillaceous, dense, brown; base concealed at quarry floor..... 2'

24. LOST MOUND SECTION

Quarry at top of Mississippi River bluff, 1.3 miles southeast of Whitton and .7 mile northwest of Lost Mound, Jo Daviess Co. (cen. NW SW 28, 26N-2E, Green Island 7.5' Quad.).

Silurian System

Sweeney Formation

Dolomite, gray, dense to finely vesicular, massive except for tight 1-3" wavy bedding planes with thin green clay partings; contains chert lenses and nodules in a 3' zone 20' above the base; corals common..... 25'

Blanding Formation (41')

Dolomite, brownish gray, mostly dense; in 2-6" beds; contains 1-3" chert layers at about 6" intervals, except in the lower 2'6", where there is little chert; good bedding reentrant at base..... 35'

Dolomite, brownish gray, dense; in 1-6" wavy beds; greenish bedding surfaces; lenses of chert 1' below top; smooth sharp bedding plane at base..... 6'

Mosalem Formation (30'1")

Dolomite, dense, laminated..... 2"

Dolomite, gray; in 1-3" beds; contains lenses of chert locally 1' below top; 6" vuggy bed 3' below top; 0-1" calcarenitic porous dolomite at base..... 5' 3"

Dolomite, pure, red-brown, vuggy; contains horn corals; 6" to..... 8"
Dolomite, argillaceous, medium to dark gray, gray weathering; ½-1" beds; interbedded with purer, very fine grained, dense, brown-weathering dolomite in lenticular 1-2" beds and lenses; contains a few thin chert lenses; massive face except for strong reentrant 3' below top.....15'
Dolomite, as above, but more argillaceous; makes reentrant..... 1'
Shale, dolomitic, dark brown, thinly laminated. 6"
Dolomite, brown, massive; slightly argillaceous but has strong argillaceous streaking in middle and at base; contains fine crinoidal debris in upper 3"..... 1' 6"
Dolomite, very argillaceous, weathers shaly; smooth surface on top..... 3'
Shale, dolomitic, black specked..... 1'
Covered to quarry floor (Ordovician Brainard Shale is exposed in gully 12' below quarry floor)..... 2'

25. PALISADES PARK HIGH-FACE SECTION

Bluff of Mississippi River in Mississippi Palisades State Park at parking area, .95 miles north of Savanna-Sabula bridge, Carroll Co. (SW SE NE 33, 25N-3E, Savanna 7.5' Quad.). Type section of Sweeney Formation.

Silurian System
Marcus and Racine Formations
Dolomite; upper part inaccessible; lower part is buff, vesicular, massive, and Pentamerus is abundant in lower 5'.....80'
Sweeney Formation
Dolomite, gray and pinkish gray, fine- to medium-grained; dense and irregular vesicular areas; in wavy, tight beds, mostly 2-4" thick, with green clay partings, except in upper 10', which has 1-5' beds with very weak partings.....55'
Blanding Formation
Dolomite, light gray to light tan, mostly fine-grained, dense; in 2-6" beds; contains many bands of white chert and beds with chert nodules (20% chert); base concealed about 5' above level of railroad.....30'

26. PALISADES PARK MAIN ENTRANCE SECTION

Mississippi River bluff, above large blocks containing Pentamerus, .2 mile north of main entrance to Mississippi Palisades State Park, Carroll Co. (SW NE SE 28, 25N-3E, Blackhawk 7.5' Quad.).

Silurian System
Racine and Marcus Formations
Dolomite, massive; mostly inaccessible for detailed study; Pentamerus abundant at base....82'
Sweeney Formation
Dolomite, gray, fine-grained; massive-appearing but has weak, thin, wavy bedding with green clay partings; contains many silicified corals.....45'
Blanding Formation
Dolomite, light brownish gray, fine- to medium-grained, slightly argillaceous, dense to finely vesicular; in 2-4" beds; contains many 2-6" layers, lenses, and nodules of white chert; corals common.....28'
Dolomite, as above but thicker bedded and contains chert only in scattered nodules in upper 2' and in band 3' below top..... 6'
Mosalem Formation
Strongly pitted, iron-stained corrosion surface.
Dolomite, argillaceous, brown, mottled greenish gray; massive except for a few tight wavy bedding planes and weak laminations; upper 1' relatively pure and vuggy, with fucoidal mottling; lower 3" is fossiliferous, vuggy, calcarenitic dolomite; strong bedding reentrant at base..... 7' 3"
Dolomite, brown, fine-grained; massive ledge but strongly laminated; upper 1' irregularly vuggy; upper 3" contains many casts of fossils; 0-1" lens of white chert at base; locally thins sharply to 6"..... 2'
Dolomite, argillaceous, light brown and green, laminated; thins out at margin of channel cut into underlying shale..... 8"
Unconformity

Ordovician System
Maquoketa Group
Brainard Shale
Dolomite, very argillaceous, soft, light greenish gray; 1'8" to..... 3'
Shale, dolomitic, greenish gray..... 2"
Dolomite, very argillaceous as above; base concealed..... 3"

27. PALISADES PARK NORTH SECTION

Mississippi River bluff .1 mile northwest of intersection of Illinois Highway 84 with roads to campground and boat ramp, Mississippi Palisades State Park, Carroll Co. (NW NE SW 21, 25N-3E, Blackhawk 7.5' Quad.).

Silurian System
Marcus Formation
Dolomite, brown, highly vesicular, massive; contains a few chert nodules in lower 5'; Pentamerus very abundant in lower 3', which has a prominent bedding break at top.....35'
Sweeney Formation (54')
Dolomite, gray, thin-bedded; contains chert nodules in upper 3', wavy green clay partings, and many corals, some silicified.....22'
Dolomite; somewhat thinner bedded than above and below; contains several thin beds of white chert; Pentamerus is especially common in the bluff about .3 mile north..... 3'
Dolomite, as above the 3' cherty zone but without chert.....29
Blanding Formation
Dolomite, similar to above but contains beds, lenses, and nodules of white chert; base concealed about 40 feet above the highway..... 4'

28. PALISADES PARK OLD QUARRY SECTION

Abandoned and largely overgrown quarry in Mississippi Palisades State Park, just north of the south boundary, .5 mile north of Savanna-Sabula bridge, Carroll Co. (SW SE SE 33. 25N-3E, Savanna 7.5' Quad.). Type section of Marcus Formation.

Silurian System
Racine Formation
Dolomite, pure, light buff to gray, medium-grained, dense to highly vesicular; some beds have large vugs; in 6"-2' beds; some beds brecciated.....25' 2"
Marcus Formation
Dolomite, buff, uniformly highly vesicular, massive; Pentamerus abundant in lower 6'; corals common in lower 2', which is transitional to the Sweeney Formation below; top is 12' above upper bench.....40' 4"
Sweeney Formation
Dolomite, light brownish to pinkish gray, mostly fine-grained, dense to slightly vesicular; in wavy 2-6" beds with green clay partings; silicified corals abundant; base concealed...23'10"

29. ROYAL PRINCESS SECTION

Upper part of Mississippi River bluff .5 mile northwest of Royal Princess Mine and

2.8 miles north of Blanding, Jo Daviess Co. (SE SW SE 21, 27N-1E, Bellevue 7.5' Quad.). Type section of the Blanding Formation.

Silurian System
Sweeney Formation
Dolomite, gray; appears massive but has weak wavy 1-4" beds; contains silicified corals...23'
Blanding Formation (51'6")
Dolomite, light brownish gray, very slightly argillaceous, dense to finely vesicular; in beds largely 6-10" thick; contains white chert in 1-8" layers and in scattered nodules; in part nearly 50% chert.....48'
Dolomite, as above but without chert..... 3' 6"
Tete des Morts Formation (20'11")
Smooth surface
Dolomite, gray, fine- to medium-grained, glauconitic, massive; contains silicified corals and thin streaks of white chert; "upper massive unit"..... 5' 7"
Dolomite, similar to above but slightly denser and in weak 1-3" beds; contains a few chert nodules; "middle cherty unit"..... 3'
Dolomite, gray, fine- to medium-grained, massive; contains a few chert nodules 1' above base; "lower massive unit".....12' 4"
Mosalem Formation (50'7")
Dolomite, similar to above, but in 1-4" beds with weak shaly partings; contains chert nodules in bands at top and 1' and 1'6" below top; strong shaly bedding break at base..... 8' 3"
Dolomite, as above, but faintly laminated; upper surface deeply pitted..... 3"
Dolomite, argillaceous, dense, light yellow-brown; in 2"-1' beds with very thin shaly partings; contains chert nodules in bands at 3', 5', and 5'8" below top; 3" laminated bed 2'6" below top; 3" pure bed with fossil debris at base..... 5'10"
Dolomite, similar to above, but not cherty; weathers to 1-2" beds, lower 6" shaly..... 6'
Dolomite, pure, calcarenitic, vesicular; contains fossil debris..... 3"
Dolomite, argillaceous at top grading to very argillaceous at bottom, gray, dense; in ½-3" beds with strong shaly partings; contains a few white chert nodules in upper 4' and one band of nodules 2'3" below top; largely nonfossiliferous; base concealed.....30'
Diamond-drill core about 2 miles northeast shows 51' of cherty argillaceous dolomite overlying 21' of noncherty, very argillaceous dolomite overlying shale of the Maquoketa Group in the interval below the 3" calcarenitic dolomite.

30. SCHAPVILLE SOUTHWEST SECTION

Roadcuts 1.5 miles southwest of Schapville, Jo Daviess Co. (NE NE 1, 27N-2E, and SE SE 36, 28N-2E, Elizabeth 7.5' Quad.).

Silurian System
Tete des Morts Formation
Dolomite, pure, brownish gray, vuggy, massive..18'
Mosalem Formation (80')
Dolomite, slightly argillaceous, brownish gray, dense to slightly vesicular; in 6"-1'6" beds with strong shaly partings; contains bands of chert nodules in upper 3'; a few 1-2" beds of brown, medium-grained, calcarenitic, pure dolomite.....15'
Dolomite, brown, dense, argillaceous; in thinner beds and with stronger shale partings than above.....10'
Covered to exposures in roadcut in hill to north, 30' to.....40'
Dolomite, very argillaceous, brown, nonfossiliferous; in weak, thin, wavy beds.....15'
Ordovician System
Maquoketa Group
Brainard Shale
Shale, green; 6" to..... 1'
Limestone, coarse, calcarenitic, brown; fossil debris abundant on upper surface, which has mega-ripples; 2" to..... 10"
Shale, green; contains 1-2" beds of very argillaceous dolomite at 1-3' intervals and a few thin beds of very fossiliferous limestone; base concealed..... 40'

31. SMALLPOX CREEK EAST SECTION

Roadcut of U.S. Highway 20 at top of hill east of Smallpox Creek, 6 miles east of Galena, Jo Daviess Co. (NE NE NW 6, 27N-2E, Hanover 7.5' Quad.).

Silurian System
Sweeney Formation (33'9")
Dolomite, slightly argillaceous, brown, dense to slightly vesicular; in 2-6" beds; contains several bands of chert nodules..... 4'
Dolomite, pure, brown, vesicular; in one bed; Pentamerus common; 8" to..... 1'
Dolomite, gray, slightly vesicular; in weak 2-6" beds; contains several bands of chert nodules. 2'
Dolomite, vesicular; Pentamerus common..... 1' 6"
Dolomite, slightly argillaceous, dense; in 2-8" beds; contains a few chert nodules; Pentamerus in upper 1'..... 3'
Dolomite, argillaceous, dense; contains green shale partings to as much as ¼"..... 8"
Dolomite, argillaceous, dense; contains 2-4" bands of chert nodules; dense smooth-surfaced beds at top and bottom..... 3' 6"
Shaly reentrant with lenses of chert..... 1"
Dolomite, gray to pinkish gray, fine-grained, massive but has thin green shaly partings and weathers thin bedded; contains many corals.... 18'
Covered..... 5'
Blanding Formation
Dolomite, very cherty; base concealed..... 5'

32. STOCKTON SOUTHEAST SECTION

Quarry in north end of ridge, south side of road, 2 miles southeast of Stockton, Jo Daviess Co. (SW SE SW 17, 27N-5E, Lena Quad.).

Silurian System
Blanding Dolomite
Dolomite, slightly argillaceous, light brownish gray; in 2-6" beds; contains 2-4" beds of white chert, except for the lower 2'6", which is without chert..... 7'
Tete des Morts Formation
Dolomite, light gray to brown, fine-grained; varied low to medium vesicularity; massive, except on weathered surfaces, where faint 2-4" beds show; top is pitted smooth surface; glauconite and thin white chert lenses in upper ledge; strong shaly reentrant with thin lenses of white clay at base..... 13'
Mosalem Formation
Dolomite, slightly argillaceous, yellow-brown, slightly vesicular, massive..... 4'
Dolomite, argillaceous, yellow-brown, very fine grained; massive-appearing but has thin shaly partings at ½-1" intervals; base concealed at road level..... 18'

33. WHITTON NORTHEAST SECTION

North end of long cliff in Mississippi River bluffs, 1/3 mile northeast of Whitton, Jo Daviess Co. (NW NW SE 20, 26N-2E, Green Island 7.5' Quad.).

Silurian System

Sweeney Formation

Dolomite, dense, fine-grained; in 1-6" tight, wavy beds with thin green clay partings; massive-appearing ledge; contains many silicified corals..... 15'

Blanding Formation

Dolomite, dense to finely vesicular, light brownish gray; contains chert in nodules and in layers as much as 8" thick (about 25% chert)..... 35' 6"

Dolomite, shaly; forms a strong reentrant..... 2"

Mosalem Formation (9'1")

Dolomite, slightly argillaceous, gray, thin-bedded; contains thin shaly partings..... 6"

Dolomite, pure, calcarenitic, brown; contains fossil debris and lenses of chert; 0 to..... 6"

Dolomite, as above, but thin-bedded..... 10"

Dolomite, as above, but not cherty..... 2"

Chert, laminated; 0 to..... 5"

Dolomite, as above; strong shaly parting with pebbles of laminated chert and silicified corals at base..... 1'

Dolomite, argillaceous, yellow-brown; contains shaly partings at ½-3" intervals; many spherical pits in basal bed..... 3'

Dolomite, argillaceous, brown, massive but has many thin shaly partings; base concealed..... 2' 8"

34. WINSTON NORTH SECTION

Quarry 1 mile north of east end of the Winston tunnel and 2.5 miles northwest of Rodden, Jo Daviess Co. (SE SW NE 11, 27N-1E, Hanover 7.5' Quad.).

Silurian System

Blanding Formation

Dolomite, very cherty, weathered..... 5'

Dolomite, light gray, dense; in 2-6" beds; no chert..... 8'

Tete des Morts Formation (22'2")

Dolomite, brownish gray, vuggy, glauconitic, massive; locally contains a few chert nodules 1' above base; "upper massive unit"..... 7'

Dolomite, light gray, argillaceous; contains persistent band of chert nodules; "middle cherty unit"..... 1'

Dolomite, brownish gray, massive, vuggy; contains chert nodules in five bands in middle of face but none at sides; "lower massive unit"..... 4'

Dolomite, as above but no chert..... 10'

Strong bedding reentrant with lenses of chert.. 2"

Mosalem Formation (14'6")

Dolomite, brown, slightly argillaceous; less vuggy than above; massive on fresh face; contains bands of chert nodules 1', 2', and 3' below top..... 6'

Dolomite, brown, argillaceous, dense; contains distinct, wavy red-brown shale partings but is massive on quarry face; chert nodules at top and in middle..... 3' 6"

Dolomite, well-bedded; in 4-8" beds; contains chert in nodules and in a persistent band 1'6" below top; a few 1-2" brown, pure, calcarenitic, and weakly laminated beds; base concealed at quarry floor..... 5'

Illinois State Geological Survey Circular 479
55 p., 10 figs., 37 geol. secs., 2800 cop., 1973
Urbana, Illinois 61801

Printed by Authority of State of Illinois, Ch. 127, IRS, Par. 58.25.

CIRCULAR 479

ILLINOIS STATE GEOLOGICAL SURVEY

URBANA, IL 61801